THE

ELECTRICAL REVIEW.

VOL. LXVIII. MARCH 24, 1911. No. 1,739.

ELECTRICAL REVIEW.

Vol. LXVIII.] CONTENTS: March 24, 1911. [No. 1,739.

	Page
The Advantages of Electricity over Gas...	457
The German Electrical Industry	458
Civil and Mechanical	459
Our Foreign Trade in the Future...	459
Regulation of Bulk Supply Voltage	459
The New Electricity in Mines Rules (*concluded*)	460
Correspondence :—	
Prospects in British East Africa	462
Insulating Materials	462
The National Physical Laboratory	463
New Electrical Devices, Fittings and Plant (*illus.*)	464
Business Notes	467
Notes	474
Progress at Wolverhampton Electricity Works (*illus.*) ...	477
Electric Driving at the Works of Messrs. Thomas Smith and Sons, Saltley	480
City Notes	482
Stocks and Shares	488
Electric Tramway and Railway Traffic Returns	488
Share List of Electrical Companies	489
Some Reflections on the New Mining Regulations	491
Proceedings of Institutions :—	
The Laying and Maintenance of Transmission Cables (*illus.*)	492
The Electrification of a Portion of the Suburban System of the London, Brighton and South Coast Railway ...	495
Legal	496
Parliamentary	498
Foreign and Colonial Tariffs on Electrical Goods	499
New Patents Applied For, 1911	500
Abstracts of Published Specifications	500
Contractors' Column ... ... Advertisement pages xxiv and xxvi	

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

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OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGREKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 988; Central 4425 (Editorial only).

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BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOIVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

NOW READY.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

1911 EDITION

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

THE ADVANTAGES OF ELECTRICITY OVER GAS.

AN evening was given recently in Dublin to the discussion by the Local Section of the I.E.E. of the comparative costs of electricity and gas, and, as may be imagined, the advantages were found to lie in one direction only. In opening the discussion, Mr. Tatlow gave the meeting some interesting data, by aid of which he was enabled to pierce the enemy's armour with deadly effect. Dublin gas has been the subject of considerable analysis by a member of the Trinity College staff, and its constitution since the statutory alteration for the worse of its illuminating power is approximately as follows :—

H	=	46·7 %
CH_4	=	21·4 ,,
N	=	10·3 ,,
CO_2	=	3·3 ,,
CO	=	14·0 ,,
C_2H_4	=	4·6 ,, including all heavy hydro-carbons.

Prior to the change of quality the value of CO was about 9 per cent., and the calorific value was about 530 B.TH.U. per cb. ft.; but from the beginning of 1910 the calorific value has dropped to 485 B.TH.U. per cb. ft.

Judging from the laments that have arisen from users of gas for lighting, heating and power, and from the unprecedented number of new connections to the electricity supply mains, it is probable that the gas company are not too pleased with their forward policy. Reference to the reduced calorific value will explain the complaint of users of gas engines that they cannot get engines which were well loaded before to do the work now, no matter how they humour the air-cock, and the plight of those unfortunates who cannot read under an incandescent mantle, and are beyond the area of the electric lighting authorities, is pitiable. And, to cap it all, the cost of gas has increased almost invariably, although the price per 1,000 cb. ft. has been reduced.

In spite of the fact that gas engines, especially of small powers, are being displaced right, left and centre, as the saying goes, Mr. Tatlow stated that the present quality of Dublin gas, at 3s. a thousand, gives 13,475 B.TH.U. per penny, whilst electricity at 1½d. per unit (power rate) gives only 2,720 B.TH.U. per penny; so that, apart from complaints about gas engines "sitting down" under the new conditions, the proved economy of electric motors must be due to :—

1. High efficiency on light loads.
2. Sub-division of power units, with elimination of much shafting and belting.
3. Extreme ease of starting and stopping, so reducing the running time.

All these are old tales, but never stale.

Possibly no advantage would be obtained by substituting a motor for a large gas engine driving direct, or nearly direct, a pump, or an air compressor, or a refrigerator, which is run for long periods at full load; but these are the exceptional cases, and accumulated experience proves clearly enough that a town's gas engine in Dublin must yield to electric power even for cost of energy, leaving out of the question matters of first cost, supervision, incidental expenses, maintenance, floor space, adaptability, nuisance, and so on.

Now, with regard to lighting, we are all nearly satiated with instances of the immense superiority of electricity over gas, and nothing new was expected from the speakers at the Dublin meeting. One after another aimed a shrewd blow

with his statistical shillelagh at the Aunt Sally of the evening, but the amusement has lost its novelty, and skill is not required to hit the old lady in a vital place since the metal-filament lamp has proved its worth.

The best that could be said for the gas mantle was that it really did give long life at fairly constant candle-power under laboratory conditions; this surprised the majority of the members, who had seen mantles working only under practical conditions, and they, after all, provide the only criteria of value to consumers.

Persons who are interested in gas are in the habit of saying that comparisons between electric light and gas are based usually upon metal-filament lamps and flat-flame burners. This is not true as a general rule, because a very good case can be made for electric light without resort to subterfuge; but many instances must have come under the notice of most of us, in which any comparison would have had to be made on these lines, simply because the consumer found it impossible to economise gas by using mantles. Draughts, dust, and vibration knock laboratory tests on the head, and many factories and workshops have found that mantle breakages became too serious an item in working charges, and as they could not get enough light from flat-flame burners, they have put in electric light, with the inevitable beneficial effect upon their pockets and tempers.

THE GERMAN ELECTRICAL INDUSTRY.

It is calculated that the turn-over of the electrical manufacturing trades in Germany amounts to a total of £40,000,000 per annum, finding employment for 130,000 workers. The works which are not owned by the three or four largest firms possess an organisation which is termed the Association of Electrotechnical Special Works, and it is computed that their share in the total annual volume of business in question is £17,500,000, and affords occupation for 60,000 out of the 130,000 workers. It may therefore be of interest, especially in view of the competitive conditions prevailing in Germany at the present time, to learn what the Association has to say on the subject in its annual report, which has just been issued for 1910.

The report states that the reason for the unfavourable prices in the past year lies in the circumstance that the large firms, which naturally exercise a material influence upon prices, are able to offer lower prices in some instances, owing to the profits realised in certain contracts exceeding the usual ratio. Thus the large firms obtain extraordinarily high prices for deliveries to electricity works and tramway companies which are associated with their own undertakings; also in connection with deliveries to those State and communal authorities which do not divide their works and contracts to the extent which is possible, having regard to the present position of electrical engineering, and which would be requisite in the interests of healthy competition. It is to be feared, the Association submits, that in the event of a further diminution in the number of large firms these price conditions will become still more unfavourable; the remaining firms, by means of an understanding among themselves, could then easily dictate prices according to their pleasure, especially in regard to large transactions. The recognition of this danger to consumers, which lies in the progressive trust formation in the electrical industry, has already led to greater consideration being given to the special works on the part of some authorities, although not nearly to the extent necessary and desirable.

The question of overland or open-country central stations is then raised by the report, with special reference to the danger of the creation of monopolies in this direction. The large firms, it is declared, are seeking to secure for themselves the profitable markets which will be opened up to the electrical industry by the establishment of overland stations, by monopolising the local distributing networks and private house installations. Certainly the Governments of a number of Federal States—Prussia, Saxony, Oldenburg, Sachsen-Meiningen, Gotha, Alsace-Lorraine, &c.—have instructed the subordinate administrative authorities to proceed most energetically against such monopolistic endeavours, and to guarantee open competition in connection with the carrying-out of installations connected with overland stations. But the minor administrative authorities, and particularly the district administrations, are only too readily disposed, on account of small pecuniary advantages which may accrue to the districts from such monopolies, to grant monopolies, even if the consumers connected with the overland stations have to pay for these small advantages in the form of a cost of installation of from two to three times the proper amount. The monopolistic efforts of the large firms, it is held, must inevitably lead to trust formation not only in the electrical industry, but also in the supply of electricity, unless the authorities intervene.

The report next proceeds to discuss the situation of the special works in 1910. The degree of employment in nearly all branches of the heavy electrical engineering department was very good, and overtime had for the most part to be worked, frequently with night shifts, and the turnover, on the average, was from 25 to 30 per cent. greater than in 1909. An increased opportunity for work was afforded by the erection of numerous overland stations, in so far as free competition was not excluded by an open or concealed monopoly in installations and materials. Notwithstanding the larger home demand, prices were unfavourable—an occurrence which is typical of the conditions of sale in the German electrical industry. On the other hand, the price conditions abroad, particularly in oversea countries, were somewhat more favourable, although competition in international markets is becoming keener.

The conditions of the workers were satisfactory in general; wages had a rising tendency, and strikes and lockouts were of an isolated character. Dealing with the most important branches of heavy electrical engineering, the report observes that makers of cables and insulated wires were very actively employed, although the cable department still suffered from the after effects of the period when the syndicate was dissolved for a time at the beginning of 1909. Public authorities in particular took advantage of the temporary lapse of the syndicate in order to cover their requirements for a number of years. It appears as if over-production prevails for the time being in the cable branch for heavy currents. The export trade, owing to high import duties, can only be maintained with difficulty and on the basis of depressed prices; and the future seems to be far from rosy. In the case of telephone and telegraph cables, business was unsatisfactory during 1910. The Post Office authorities manifested great reserve in the placing of orders, and prices show a declining tendency. Makers of insulated wires were exceptionally well employed during the year, but prices were unfavourable, this being brought about by new works. The degree of employment in connection with dynamos, motors and transformers was considerable, especially in the second half of the year, although prices were bad and almost resulted in a loss. The severity of the competitive fight is evidenced by the circumstance that various works were compelled to go into liquidation, as for instance, the firm of Ernst Heinrich Geist Elektrizitäts Gesellschaft, of Cologne, and the Saarbrucken Elektrizitäts Gesellschaft, of Saarbrucken. On the other hand, prices in the export trade, especially in oversea countries, were occasionally somewhat better, despite the greater expenses; but competition is becoming still more difficult in European markets. The makers of installation materials and appa-

ratus for heavy currents were well employed, both on home and export orders, although in these cases also a perceptible pressure upon prices was exercised by small new works, and the degree of activity in electricity meters and measuring instruments was also good throughout in the face of very keen inland rivalry.

The glow lamp industry is stated to have been very well employed in general, although a decline took place at the end of the year. As might be expected, the manufacture of carbon-filament lamps had to suffer from the competition of metal-filament lamps. Nevertheless, the prospects for the wire lamp branch are declared to be by no means too favourable. An overproduction has already led to a large reduction in prices since the A.E.G. commenced to lower quotations in the spring of 1910. The export markets especially suffered from the fact that native wire lamp factories had been established in a number of countries, and these are said to have been cutting prices. In transmarine countries the German wire lamp makers encountered the competition of North American lamp works, and, as a consequence, the prices in these places declined to such an extent in 1910 that they were almost lower even than those in Germany. The domestic trade in arc lamps was affected by the tax on illuminating articles, and sales noticeably diminished. The export market continued satisfactory. As to the manufacture of carbons, this branch was also disturbed by the tax in question, and the inland business was unfavourable, whilst the export trade was good. The insulated tube branch was well employed both on home and foreign account during the year, although prices were not satisfactory, and makers of artificial insulating materials were also well occupied.

The report, in conclusion, refers to the present year, and states that the degree of employment of the special works has not lessened, whilst at the same time no change has been perceived in the tendency of prices. It is submitted that this state of affairs can only continue so long as the amount of employment is sufficient, but serious injury is declared to be inevitable when the condition of trade in this respect undergoes an unfavourable change.

Civil and Mechanical.

In the course of his interesting address as President of the Institution of Mechanical Engineers, delivered last week, Mr. E. B. Ellington dealt with the question of the sub-division of engineering, and remarked that it was quite impossible for a single Institution to deal at all adequately with every branch of engineering. The Institution of Civil Engineers was founded in 1818 to embrace all non-military engineers, but then, and for many years afterwards, engineering consisted mainly in the construction of roads, harbours, &c., and the Institution of Civil Engineers became associated in the public mind with that particular branch of engineering, of which it has remained the special exponent. Its original *rôle* could now only be fully met, said Mr. Ellington, by the several branches of engineering science being separately organised. As long ago as 1849, the then President of the Institution of Civil Engineers, referring to George Stephenson as the President of the Institution of Mechanical Engineers, said: "These two societies embrace the whole science, and by combining their efforts, with mutual goodwill and a perfect understanding, they may, and do, confer great benefits on the public. Mr. Stephenson practised both as a mechanical and a civil engineer, and attained equal eminence in both branches of the profession."

Mr. Ellington, pursuing the subject, pointed out that typical civil engineering works were all of a stationary character; in fact, the essence of civil engineering was "rest," while the essence of mechanical engineering was "motion." Docks and harbours, for example, were the direct results of the development of mechanical engineering in its application to ocean traffic. He wished to make it clear that mechanical engineering was of equal importance with any other branch.

These remarks and quotations have an interesting bearing upon the subject which was discussed in our columns some months ago; here we have a President Inst. C.E., as long ago as 1849, and a President I.Mech.E., of to-day, both drawing a clear distinction between civil engineering and mechanical engineering, and between the corresponding Institutions, yet we have been told that the former embraces all the rest!

Our Foreign Trade in the Future.

The appeal of Lord Furness for the adoption of a larger National Trade policy for extension of British trade overseas has not fallen upon deaf ears. His Lordship's experience enabled him to express himself with such conviction and force as to compel attention, and the articles and correspondence appearing in the *Times* have led to a general discussion of the question, which, to our mind, was much needed, and can only end in advantage to our varied industries. In one of his communications Lord Furness suggested the formation of an organisation to further the movement which he had at heart. We agree with the *Times* that to give inspiring leadership in such a movement nobody was better fitted, either by reputation or experience, by zeal or close industrial interest, than the man whose appeal had fixed the attention of so many upon the urgency of "revising our attitude towards the problem of retaining our existing markets and securing new outlets for our productions." Happily, so far as the electrical industry is concerned, the attitude of many electrical trade-seekers has already been revised as the result of our own and others' urgings, but there is still more to be done if we are to show a unanimous front in all parts of the world. The engineering trade in general is also doing far better than ever before in foreign trade; but what we are doing already is not to satisfy us, good as it may be at the moment. We must continue to be aggressive, and simultaneously must be occupied with wide plans and deeply-laid foundations ensuring our trade security and progress in the future.

It is stated that Lord Furness's proposition for a Chartered Institute of International Commerce has been to some extent met by the formation of a committee by the Royal Colonial Institute. That committee counts among its members at least one well-known name in the electrical industry. Whether it be through the medium of this committee for colonial trade, or by an institute on the lines suggested by Lord Furness for world trade, which is a far bigger thing than colonial trade, is not a matter of great consequence, provided that something definite be done which begets in all our manufacturing breasts a stronger zeal for trade-getting abroad. He who stimulates our interest in colonial trade will make us seek it elsewhere too. The Colonial Institute Committee, of course, has our hearty good wishes for its success, but may we hope that Lord Furness will not relax his own personal interest in the subject?

Regulation of Bulk Supply Voltage.

A correspondent, referring to the Legal Query in our issue of March 10th, points out that the obvious way of distributing energy received in bulk is by motor-generators, and these may generate either alternating or continuous current. This is, in fact, how it is done; the speed of the motors is controlled by the regulation which limits the variation of frequency to 2½ per cent. from a declared frequency. Our querist, however, explicitly barred the use of rotary transformers, by which he presumably means motor-generators (the former term is generally restricted to D.C.—D.C. transforming sets), as well as of automatic voltage regulators; under these circumstances the problem cannot be solved. It appears, therefore, to be obligatory for the distributors of a bulk supply to use motor-generators, if they wish to comply with the regulations of the Board of Trade.

THE NEW ELECTRICITY IN MINES RULES.

(*Concluded from page* 419.)

The Committee refers to "armouring" because this seems the easiest method—it is at any rate the readiest—of protecting the cable with a metallic covering, and the view of the Committee is that: "The effectiveness of the resistance of an armoured cable to mechanical damage clearly depends on the strength and thickness of the metallic covering, and in those cases in which armoured cables have proved to be unsatisfactory, the Committee considers this to have been mainly due to the use of armouring which has been either *too light* or *insufficiently protected* from the action of corrosive pit water." In order, therefore, to prevent failures, "metallic sheaths must be of not less thickness than is recommended by the Engineering Standards Committee," and "efficiently protected against corrosion." But will the thickness recommended prevent a runaway tub severing the armouring and driving it into contact with the live wire, and can corrosion be prevented? It must be remembered that corrosion is an insidious creeping thing, that often acts so slowly that anyone accustomed to seeing a cable day by day, might easily think it was in quite good order, when really it was—either wholly or in part—very bad. Again, with regard to heavy falls or runaway tubs, the Committee recognises that there may be some difficulty, for it says: "In special cases where there is danger of very heavy falls, or of runaway tubs, or severe mechanical damage, it may be desirable or essential to increase still further the thickness of armouring or otherwise to protect the cables." It appears reasonable to think therefore—considering everything—that plain, heavily-insulated cables laid in troughing and filled in solid with bitumen, would be preferable to any form of armoured cables.

Where cables are joined up to motors, switches, &c., the metallic covering must be securely attached to the casing of the apparatus; and the insulating material of each cable end must be sealed off inside the box, and to secure gas tightness, or prevent abrasion, the cables must pass through properly constructed bushes. All of which is reasonable and in accord with the best present-day practice. In regard to joining up cables, the report very properly draws attention to the careless and slovenly way in which cable connections are made underground. "Conductors below ground joining up motors to switchgear are in many cases hopelessly mixed up, rendering it impossible to trace them out readily, resulting in mistakes in re-making connections, apart from the more serious risk of fire. Such conductors should be carefully run and securely fixed." In connection with this, it is a good plan to have near every motor a clearly drawn diagram of the whole of the connections, with a number stamped on each terminal, and the same number marked on the diagram; the various lengths of connecting cables should be fitted with substantial brass or copper connecting ends, with plenty of contact surface, and a low current density. Even for very small motors the terminals ought to be substantial, although, according to ordinary practice, they may appear out of all proportion to the current they have to carry. Screw-down or plug terminals are the best to adopt, according to which is the most convenient to use. In the case of plugs the tapered plug part should be on the cable end, and it should be *long*, so as to give ample contact surface. With screw-down connections the "eye" should be fitted to the cable, and the bolt should *never be less* than *five-eighths* inch. This precaution is too often neglected by even the best known makers of electrical plant who have a high reputation for colliery work. The very smallest detail needs just as much attention as the steam engineer would have to give to high-pressure steam plant. In the latter a weak point would soon show by a blown out or leaky joint, but, with the former, leakage or heating may go on unnoticed until it results in a more or less serious accident. In no case is this more likely to occur than in junction-boxes, where very often too little attention is given. As an illustration, a case occurred at a large colliery in the North of England, which might have resulted in serious consequences. A large junction-box, which was installed under strict supervision, and supplied by a high-class maker, suddenly exploded, bursting the box and shooting into flame. The box was filled in solid with bitumen, and on making an examination *no fault* could be found. There *must*, however, have been a fault, and undoubtedly this was due to a bad or faulty connection on one or both terminals, with the result that continuous heating took place, melting and volatilising the bitumen, which finally exploded. This would have been prevented had there been ample contact surface, which should be designed according to the amount of power passing through it. It is not enough merely to consider the amount of current passing, as a connection suitable for, say, 50 amperes at low or medium pressure is quite unsuitable for a 50-ampere connection at high or extra-high pressure. The same principle applies to all terminals in connection with fixed and portable motors, and especially with the latter, means should be provided for properly securing them. It is also to be noted that "metallic covering for flexible cables is *not*, as a rule, desirable," and "flexible cables for portable apparatus should be tested to *four* times the working pressure before being put into service. This applies both when the cable is new and after it has been repaired."

The next point of importance relates to "earthing" the system, and to cover this a special rule (Rule 8) is introduced.

Briefly, the rule states that all metallic sheaths, covers, handles, joint boxes, frames, bedplates, lampholders, &c., "shall be earthed by connection to an earthing system at the surface of the mine," and as the report says: "This rule covers the best safeguard against electric shock that exists in underground conditions."

It is indisputable that had greater attention been given to this important phase of underground electrical work, many fatal accidents would have been prevented. But though attempts at earthing have been made, they have in most cases been very unsatisfactory, and the question is—How can a good and reliable earth be best obtained? On this point the report says: "In order to make good connection with earth, the earthing system should be of sufficient capacity, having regard (1) to the current it may have to disperse, and (2) to the nature of the surface ground and its condition as regards moisture. As so much depends upon the earth connections being in order, and as earth plates are necessarily out of sight, it is advisable always to provide *at least two* plates placed at some distance apart, but connected together in case of the failure or disconnection of one of them. Two earth plates properly placed 20 or 30 ft. apart in good surroundings and connected to each other, are nearly twice as efficient as a single earth plate equal in surface area to the two together."

As to the conductor the Committee suggests the armouring or metallic covering of the cables, but we cannot agree that this is absolutely satisfactory, as we have already shown when dealing with fatal accidents on previous occasions, and as we have repeatedly pointed out, in our opinion the *only* way to get a safe and satisfactory earth underground is to run a separate wire, either bare or insulated, but preferably the former, direct from an earth plate or plates—as suggested by the Committee—on the surface, down the shaft and inbye, and to connect this to every exposed piece of metal covering, frame, or bedplate, comprising the installation. This view is, however, only reluctantly admitted by the Committee, which says: "The most satisfactory method is to use cables provided with an efficient metallic covering, and to connect this covering to the earthing system at the surface, using it for all underground connections. *Failing this, it is necessary to run a special earth cable throughout the installation connected to the surface earthing system.*" Further, "Earth cables are often bare, and where they are of the proper size, and the earth connection is efficient, there can be no objection to this. In many cases a stranded earth cable is to be preferred for use below ground to a solid wire of the same conductivity." The whole purpose and object of an earth cable is to reduce the resistance of the earth to the passage of a current of electricity, and consequently the cable should be in constant contact with earth, so that, should it accidentally become broken, the effect would be merely to increase the resistance of the earth at that point. It is difficult to see, therefore, what advantages could be obtained by putting in an insulated earth cable.

It is also to be noted that earthing is not required where the pressure is less than 250 volts D.C. or 125 volts A.C., and that "a good earth connection should be regarded as of even greater importance than a good connection in the supply circuit."

What is, however, of the very greatest importance in all colliery installations, from the points of view both of its satisfactory working and of the prevention of accidents, is its adequate inspection and maintenance, and on this point the Committee states: "All underground apparatus requires periodical examination if accidents and dangerous occurrences are to be avoided, and the *competence* of the person appointed to supervise electrical plant below ground is, therefore, a matter of *great importance*." The existing rule, which deals with this point, reads as follows: "A competent person shall be on duty at the mine when the electrical apparatus or machinery is in use," but this, in the opinion of the Committee, is too vague. With this most people will agree, but at the same time they will probably also agree that, under the new rules, the position—in regard to the competence of the person on duty—is very little, if at all, improved. No doubt the question bristles with difficulties, and is one which can only be solved by gradual evolution in the course of time. At any rate, the Committee evidently did not feel equal to dealing fully and thoroughly with the matter, and more or less shelved it. Under the new rules it is provided, to quote the report, "that the person appointed to supervise the electrical apparatus (*the electrician*) shall be appointed in writing, and be *competent* for the work he is set to do;" and, further, it clearly specifies the more important duties for the performance of which he must be responsible, *without*, however, interfering with "the *covering responsibility of the manager* under the Coal Mines Regulation Act." That is to say, the colliery manager is still responsible to the law for the efficient working of the apparatus and the prevention of accidents; is still to be the judge of the competency of the person appointed, and the only difference is that the competent person is appointed in writing instead of verbally, and the duties are more defined in the rules.

It was suggested that certificates of competency be issued after examination by the Home Office to colliery electrical engineers, but the Committee says: "Such certificates could only refer to technical knowledge, and the Committee considers that, however well certificated a man may be, considerations of habit and character are of even greater importance in this connection than technical knowledge. Safety and efficiency would be more likely to be promoted by the employment of a conscientious and resourceful man than by the employment of a man who may have the advantage as regards technical knowledge, but who is inferior as regards thoroughness." All this is, no doubt, quite true; but, at the same time, every word of the foregoing might equally be applied as an argument against the granting of certificates to colliery managers, and, surely, a man is much more likely to be thorough with some technical knowledge than without. But, "apart from the fact that the person appointed . . . must necessarily be under the orders and control of the mine manager, the use of electricity below ground has extended so widely that, in the opinion of the Committee, greater attention than is usual at present should be given to the electricity section in the examination for a colliery manager's certificate. If the colliery manager is not in possession of at least a knowledge of the essential points of good apparatus and workmanship, he is *unable intelligently to criticise* and *check* the work, and he is . . . *completely in the hands of the electrician*." The Committee acknowledges that the use of electricity in mines has widely extended, and that the colliery manager should know more about electricity. But the question is: How much more? And what sort of knowledge ought he to possess? For answer we read: "Every colliery manager, for example, should be able to say whether a cable joint made or opened in his presence has been well made or not, and whether the joining up of cables to apparatus has been well carried out or not." And "It is not suggested that the colliery manager need necessarily be qualified to judge as to the suitability of apparatus from an electrical standpoint, as this requires *considerable knowledge and experience*, and in most cases it is necessary, apart from a question of safety, either to obtain expert advice or to purchase from a manfacturer whose mining apparatus is known to be of first-class construction and liberal design." Practically one statement contradicts the other. In one, the colliery manager is to pass an examination in electrical engineering, but in the next he need not have sufficient knowledge to be able to select electrical apparatus for use in a mine. But he may call in an expert to advise him who has not been called upon to undergo any examination. Poor colliery manager! Surely he deserves the sympathy of the electrical world in the unenviable position in which he is placed.

We have on several occasions pointed out the unfairness of making the colliery manager responsible for the electrical plant, of which it is impossible that he can, generally speaking, have an extensive knowledge. No man can be expert in all things, and in our opinion—which we have frequently expressed—there ought to be another certificate to include the mechanical and electrical engineering of collieries, and the holder of this should be responsible to the Home Office for the proper installation and working of the plant; and we are still hopeful that this will come in time. As things are, owners frequently appoint engineers, who are quite independent of the manager, to design and supervise the plant, as they find it pays them to do so, and it is only right that the Home Office should insist on holding these engineers responsible to the law as they are to the owners.

The Committee, however, has tried to meet the position by providing that: (Rule 14) *(a)* "Every person appointed . . . . shall be competent for the work that he is set to do. No person, *except* an authorised person or a competent person acting under *his immediate* supervision, shall undertake any work where technical knowledge or experience is required . . . ." *(b)* "A person shall be appointed in writing by the manager to supervise the apparatus. The person so appointed, hereinafter called 'the electrician,' shall be over 21 years of age. If necessary . . . the manager shall also appoint *in writing* an assistant or assistants to the electrician." *(c)* "The electrician shall be in *daily* attendance at the mine. He shall be responsible for . . . (i) The thorough examination of all apparatus (including the testing of earth conductors and metallic coverings for continuity) *as often* as may be *necessary to prevent danger*; and (ii) the *examination* and *testing* of all new apparatus, and of all apparatus removed from one position in the mine to another before it is put into service." . . If the electrician is away for more than a day "the manager shall appoint *in writing* an efficient substitute," and lastly *(d)* "The electrician shall keep at the mine a log-book made up of daily log-sheets (which) shall be produced to an inspector of mines on his request."

These are certainly a great improvement on the old code of rules, and if properly carried out will do much to prevent those accidents which in the past have been due to carelessness, ignorance, and the want of efficient supervision.

Indian Notes.—Our correspondent writes as follows:—"*Royal Durbar, Delhi.*—Specifications were recently issued for the following: (1) Self-supporting steel chimney; (2) nine boilers, total evaporative capacity 90,000 lb. of steam at 160 lb. pressure—Lancashire or water-tube; (3) mechanical stokers; (4) feed pumps and injectors; (5) feed water heaters; (6) steam and exhaust pipes; (7) steam-driven generating sets, either turbines or high-speed Belliss or other similar type; (8) generators, four 600-KW. sets, either alternating current 2,400 volts 50-cycle, or direct current 450-volt sets; (9) switchboard; (10) transformers or balancers; (11) auxiliary electrical apparatus. Estimates were to be sent to Electrical Engineer-in-Charge, Delhi Durbar Works, by March 7th. Ample latitude was allowed for alternatives, as the plant is required only for next cold weather. Steam plant to be erected by June, and complete plant by July, 1911. Preference is to be given to tenderers who will hire the whole plant, or, what is equivalent, repurchase it after the Durbar. This is a good opportunity for central station engineers who may be contemplating liberal extensions in a year's time; but for contractors who would presumably have to buy a plant from home and have it on their hands after the Durbar, the scheme is not a fascinating one. The proposals are sound ones from a Durbar standpoint, and it will be interesting to wait and see what is eventually settled upon."

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CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment No letter can be published unless we have the writer's name and address in our possession.*

Prospects in British East Africa.

I have received several inquiries from electrical engineers at home as to whether there is an opening here for an electrical contractor.

At present all installation work is carried out by the Nairobi Electric Power and Lighting Co., Ltd. (who are the suppliers of electrical energy), and all fittings are also supplied by them.

The price charged for wiring—per point of any description—is Rs. 23.00 (30s. 8d.). This, in my opinion, leaves a splendid margin of profit, considering that wire, &c., only advances 33⅓ per cent. at the outside, on the home price.

Indian labour here is fairly cheap (£5 per month), and native labourers are paid at the rate of 6s. 8d. per month.

As Nairobi is growing rapidly, I should say that there is a good opening for a steady young man, and particularly if he were also able to put in small water schemes, such as rams, &c.

For the first year he would of course have to be prepared to keep himself without relying on his business. This would cost him—if he were very economical—at least £150, as living here, and especially in Nairobi, is none too cheap.

Salaries here run from £180, which is the minimum one should come out here for.

With regard to the climate, I should say Nairobi Hill is as healthy a spot as can be found in Africa.

Adviser.

Nairobi, B.E.A., *February 12th*, 1911.

[Particulars of this kind are always very welcome; we invite them from all parts of the world.—EDS. E.R.]

Insulating Materials.

With reference to your remarks on insulating materials, I believe ozone was suggested years ago as the cause of failure in high-tension machines where material, which did not exclude air, was used as an insulator. I think it was in a paper read by Mr. Symonds at the Students' Section of the Institution.

For this reason I have used inert oxides as insulating materials in conjunction with wood oil varnishes; my firm have been making them since 1905, and the results are undoubtedly better than if linseed oil varnish alone were used.

With regard to the green deposit, even when the varnish has no trace of organic acid, this, I believe, is due to the use of rosin as a flux when soldering takes place. Rosin contains from 7 to 10 per cent. of organic acid, and it runs into the windings when the joint is heated. So-called "acid-free" rosinous compounds will show on test from 3 to 5 per cent. of organic acid, and any of these will, with linseed varnish, show a green copper compound in a very short time.

The use of a properly neutralised inorganic acid flux in place of rosin removes this trouble, and my tests show it to be quite safe.

Percy Good.

London, S.E., *March 21st*, 1911.

As one of the largest suppliers in Europe of insulating materials, we have, like Messrs. Wiggins & Sons, followed with the greatest possible interest in your columns, and those of your contemporaries, the discussions which have been reported from time to time upon this subject. We have also read with very great care the interesting and able paper by Messrs. Fleming and Johnson upon "The Chemical Action of the Windings of High-Voltage Machines," and have no hesitation in confirming the conclusions at which Messrs. Fleming and Johnson have arrived.

Our long experience in the manufacture of electrical insulating mediums of all kinds has taught us that for high-tension work there is probably no other form of insulation existent that possesses the same advantages, and permits of such a high "space factor" being attained in the construction of a high-tension machine, as a pure micanite tube. The many other advantages in the employment of these tubes are so well known to designers of high-tension machinery, that we do not think it necessary to recapitulate them here, but we would mention that such tubes must be regarded by the electrical industry as entirely distinct from what are generally known as "Standard Micanite Tubes." The latter frequently contain a certain amount of paper or other fibrous material, and are not altogether suitable for the purposes named herein. The tubes here referred to consist entirely of mica and a special adhesive insulating varnish. It is obvious, in order to attain the results desired by Messrs. Fleming and Johnson, that it must be our object, since the adhesive cement employed (like all other varnishes) necessarily contains a certain amount of organic matter, to use as little of it as possible. These tubes are so made that in the course of manufacture the adhesive matter, or cement, is eliminated to such an extent that only the smallest amount necessary for ensuring the thin laminations of mica or "splittings" adhering to one another remains. The tubes when completed, therefore, are the nearest approach to pure mica tubes that it has been found possible to manufacture, and if they are properly and carefully made, they will be found quite unaffected by the chemical action with which Messrs. Fleming and Johnson deal, and it follows, therefore, also by the nitrous fumes of which they speak in their paper read before the Institution.

Messrs. F. Wiggins & Sons, in their letter addressed to you under date March 14th, seem to have entirely overlooked the insuperable difficulties, and, in fact, the practical impossibility of the employment of pure mica for this slot or tube insulation, not to mention the excessive cost which, even if this were possible, would be absolutely prohibitive. There is further the impossibility of bending pure mica, or making it conform to the particular shape required to insert it in the slot or orifice in the armature stamping. To crack the pure mica, which this would entail, would mean to destroy entirely its insulating properties. Added thereto, there would always be the uncertainty of the varying dielectric strength of mica in its raw state, so well known to those who have studied this subject of pure mica insulation. Two pieces of pure mica of like thickness, emanating from the same mine, seldom, if ever, give anything like the same dielectric piercing capacity. In micanite this uncertainty is, of course, overcome, due to the fact that the films or splittings of mica employed in its manufacture overlap one another, thus producing an average dielectric resistance. The moulding possibilities of micanite are now too well known for us to mention them here.

In conclusion, we must respectfully join issue with Messrs. Wiggins as to the employment of pure mica for this purpose, and regarding micanite tubes falling to pieces. In the course of our long experience, and we have naturally supplied thousands and thousands of these tubes, never has a single case of this kind been brought under our notice, even when the tubes have been, as they so frequently are, employed in the construction of turbo-alternators, where they are subjected to high centrifugal force, which naturally tends strongly to disintegrate the mica of which they are composed.

Whilst, however, we cannot agree with Messrs. Wiggins in all their conclusions, there is one we do most entirely endorse. No stress too great, and no words too emphatic, can be employed by us to impress upon your readers the point raised by them as to the supreme importance of using only the best insulation possible in the manufacture of these high-tension machines; and, in fact, in all electrical machinery. We are fully in accord with their view that many manufacturers of high-tension and other electrical machinery, in their attempts to lower their cost of manufacture, seem to utterly disregard the fact that, though the insulation forms only a trifling percentage of the total cost of, for example, a large alternator, these manufacturers are inclined to risk the efficiency of their machines, merely for the sake of saving what, practically speaking, is a few shillings

in the cost of the insulation. It is quite impossible for the manufacturer of insulating materials or micanite to employ the best quality of mica or cement if he cannot obtain a price for his manufactured goods that will defray the cost of his raw materials. It is equally out of the question to avoid the dangers of which Messrs. Fleming and Johnson speak, and which are apparent to anyone who has any knowledge of the subject, except the very highest grade of *matière première* is employed in making the insulating materials. It follows, therefore, that unless the manufacturers of electrical machinery will assist us by paying us a better price for a better article, we cannot accomplish that which Messrs. Fleming and Johnson have in view. If insulating materials continue to be purchased upon the merits of *price*, and *price* alone, the faults will continue *ad infinitum*. As is the case in every other manufactured article known to us, the quality must enter into the calculations as well as the price, and there is probably no article in which this factor enters more largely than "micanite" and other similar materials used for electrical insulation. If the electrical industry will only take cognisance of this view (we appeal to those who both manufacture and purchase their insulating material) we think that a good deal may be done to guard against the evils into which Messrs. Fleming and Johnson have made such a thorough and exhaustive investigation.

By those who manufacture micanite, it will be found that not only is there no advantage in using a cheap quality of "splitting" so far as cost is concerned, but that there are other great dangers attendant thereupon; and what applies to the "splittings" also applies to the cement used and the method of manufacture. It is no longer possible, as in the old days, to manufacture insulating materials in the "paint shop." To do this scientifically, and therefore effectively, the best of materials, a great deal of up-to-date machinery, proper testing rooms with instruments of various ranges, and scientific and technical experts, are needed. We are constantly engaged in attempting to improve methods of insulation which have for their object the reduction, among others, of those faults of which Messrs. Fleming and Johnson complain, and we shall be pleased at any time to co-operate with any of those interested in this wide subject of insulation, for we agree that there is yet much to be learnt with regard to it. This, however, cannot be done without expenditure of money and brain tissue, and unless the electrical industry at large is prepared to recompense the manufacturer for his outlay in this direction, we cannot expect that advancement and improvement which is to be desired, as Messrs. Fleming and Johnson make clear by their investigations, for which all manufacturers, like ourselves, no matter how up-to-date their factories may be, must owe them a debt of gratitude.

The Micanite and Insulators Co., Ltd.

London, E.C., *March 21st*, 1911.

THE NATIONAL PHYSICAL LABORATORY.

The Report for the year 1910, submitted by the Executive Committee to the General Board on the 17th inst., shows steady progress in all departments of the Laboratory. The national experimental tank is practically complete; the thanks of the Committee are awarded to the contractors, Messrs. Dick, Kerr & Co., Ltd., and their engineer, Mr. D'Arcy Madden, for the way in which the work has been done and the electrical equipment adjusted. Sir Julius Wernher has presented £10,000 to enable the Committee to carry out the needed extension of the Metallurgical Department, which has also been entrusted to Messrs. Dick, Kerr & Co. The Meteorological Office has taken over the observatory work at Kew and Eskdalemuir, and the test work on thermometers, watches, &c., will ultimately be removed from Kew to Teddington. The adoption of the new value for the E.M.F. of the Weston cell is mentioned. The Lorenz machine is practically completed. Progress has been made with the preparation of photometric standards, and with researches on insulating materials, the strength of copper wire, &c.

The tests carried out show an increase on the whole, mainly due to taximeter testing. Tests in electrotechnics, &c., have fallen off as compared with 1909, but show an increase on 1908, a very large number of fuses and a good many primary cells having been tested in 1909. In photometry, incandescent lamp tests, which form the great bulk of the work, have fallen to less than half as compared with 1909. While some types of instruments and tests show a steady increase year by year, others show remarkable fluctuations.

The income of the laboratory has risen from £24,270 in 1909 to £28,077 in 1910, and the net receipts for work done have gone up from £14,241 to £15,363. The total expenditure exceeded the receipts by £222, but a considerable amount has been spent on the equipment of the laboratory. During the past 11 years the total receipts on capital account have amounted to £103,432, of which the Treasury has provided £44,000; and the revenue account receipts have amounted to £163,131, of which the Treasury has contributed £57,750.

During the current year the main feature of the work of the Physics Department will be the absolute determination of the ohm by means of the Lorenz apparatus, and new mercury standards of resistance will be made, including five for the Imperial Japanese Laboratory. The work on wavemeters, inductance measurements, and iron testing will be continued. New sets of sub-standards of light will be standardised, including Osram standards presented by the General Electric Co., Ltd. The effect of railway journeys on meters will be investigated, and the heating of lamp sockets for radiators. Electrostatic methods of measuring power are being perfected. A wide variety of work in connection with thermometry, metrology, optics, engineering, aeronautics, and metallurgy is also in progress.

The detailed reports of the staff to the director, Dr. R. T. Glazebrook, contain an abundance of interesting matter, which we can only briefly deal with. In Mr. F. E. Smith's department, the progress made with the Lorenz apparatus has afforded very satisfactory results, the constancy of speed being remarkably good.

Mr. Smith took part in the international investigation into the E.M.F. of the Weston normal cell at the Bureau of Standards, Washington, where large numbers of cells made by the four National Laboratories concerned were compared; the mean difference of the respective sets from the mean of all was in the case of the Reichsanstalt zero, the Laboratoire Central + 9 microvolts, the Bureau of Standards −9 microvolts, and the National Physical Laboratory −2 microvolts—a most satisfactory agreement. Representatives of the Russian and Japanese Laboratories have made up a number of cells at Teddington, with good results.

The Ayrton-Jones current balance continues to give satisfaction, and the electrochemical equivalent of silver determined with its aid agrees within one part in 100,000 with the results obtained by Prof. Mather and Dr. Lowry in 1907. An improved form of silver voltameter has been developed.

In Mr. Campbell's department the construction of highly non-inductive resistances, and the measurement of their small "residual" inductances, were investigated, and it was found possible to obtain almost exact compensation for the residual inductance by utilising the small distributed capacity of the coils. A box is under construction in which the self-induction of none of the coils will be above 0·1 microhenry. The inductance of a 10-ohm coil can be measured to about 0·02 microhenry. In tests on the loading of telephone cables it was found that the effect of the mechanical treatment in winding a thin iron strip on the core was to reduce the permeability of the iron to about half its original value. The determination of the power factor of standard condensers has been taken in hand, but presents considerable difficulty, as the power factors are of the order of 0·001 at 100 cycles per second. An investigation of the losses in various samples of iron is in progress in conjunction with the American and German Laboratories. The construction of wave-meters has been further developed, and a glass condenser in oil with sub-divisions of 0·001 to 0·005 mfd. has been made.

In the department of Electrotechnics, Mr. Paterson has continued the establishment of new series of sub-standards of light; in this connection, while forming the "cascade" series from low to high efficiency, to minimise the effect of the colour of the light, difficulty has been experienced, as high-efficiency metallic-filament lamps show small but erratic candle-power fluctuations, while the resistance of the filament remains constant, and the cause of the trouble has not yet been discovered. The set of 2-watt per candle sub-standards has had to be superseded by a new set specially made by the General Electric Co., and a similar set of 1·5-watt lamps is now under observation, which will complete the chain. Low-efficiency sub-standards are being tested for the purpose of maintaining the international agreement as to the unit of light. The visibility of ships' lights at sea—the green light in particular—has been the subject of investigation during the year, and experiments have shown that it is possible to perceive one-millionth of a candle-power at a short distance. The study of the quadrant electrometer used as a watt-meter has been continued. There is reason to believe that supply meters after a journey by rail alter their rate, and a series of tests is in progress with different makes of meters to settle the point. The heating of lamp sockets used for large lamps has been under observation, but the experiments have not been completed yet. Researches into the electric strength of micanite, the deterioration of ebonite, and the characteristics of other insulating materials have been carried on for Government Departments and for the Engineering Standards Committee. It is found that with micanite at high pressures brush discharges are produced in the neighbourhood of the electrodes which heat the micanite and soften it; the thicker the samples, the lower the electric strength, and it is difficult to produce thick sheets which will stand a stress of 20,000 volts per mm. for 10 minutes. Breakdown appears to be a secondary effect due to the weakening by the heat of the brush discharge. It has been found impracticable to prevent the formation of free sulphuric acid on the surface of ebonite exposed to light; yellow glass screens greatly reduce the action, but the only satisfactory protection is to cover all ebonite with wood or other opaque

material. Amberite has proved satisfactory as a partial substitute for ebonite. Shellac varnish on the surface of ebonite does not prevent the formation of acid. The latter can be removed and the insulation restored by thorough washing, and the rate of production of acid diminishes as time goes on, the colour of the surface becoming a greenish grey; such a surface is electrically as good as, and more permanent than, the polished new black surface.

Mr. Rayner's work on insulation indicated the importance of air spaces in insulating materials subjected to electric stress, and this led to an investigation into the critical electric stress at which air ceases to insulate, the results of which were described in the discussion on Mr. E. A. Watson's I.E.E. paper. Tests on pure mica show that it has an exceedingly high electric strength—up to 300,000 volts per mm. Tests on the heating of cables have also been in progress for the Wiring Rules Committee of the I.E.E.

Dr. Harker has been engaged on the prolongation of the gas-thermometer scale to high temperatures, and the development of a vacuum furnace for work up to 2,500° C. An investigation into the apparatus used in testing the flash-point of petroleum has been carried on, as well as a series of tests on the Siemens calorimetric water pyrometer, the specific and latent heats of fusion of metals, and other furnace work. The experience gained during the past eight years in the construction of furnaces of all kinds, especially electrical, is being embodied in a paper to render it readily accessible to the public.

In the Engineering Department Dr. Stanton has continued his researches into the effect of wind pressure on structures, the heat transmission and friction of air currents in pipes, and various other subjects. In particular, we may instance a research on copper and bronze wires for the Post Office, the India Office, and the National Telephone Co. Samples 50 ft. long were tested, and it was found that the moduli of elasticity determined from these lengths were materially smaller than the values obtained from short specimens; but this proved to be due to the values being derived from the first loading of the specimens, and thus including any elongation due to straightening kinks remaining in the wire after uncoiling. The values of the linear coefficients of expansion of the wires were also determined.

Experiments carried out for the Screw Threads Committee, on the resistance of screws to shock, conclusively proved that the British Standard Fine thread was much superior to the Whitworth, U.S. Standard, and U.S. Vee threads, the difference increasing as tough her steels were used.

The aeronautical and petrol-motor testing work of the Laboratory can only be mentioned in passing, and the same applies to the work of the Metallurgical Department.

The report of the Advisory Committee for the national experimental tank is appended, and includes a brief description of the towing carriage and electrical propelling apparatus. The carriage weighs 14¼ tons, and is driven at a maximum speed of 17 miles per hour through worm gear by four motors with vertical shafts, supplied with power by trolley wires fixed on the wall of the building. A motor-generator driven from a storage battery feeds the conductors. The main tank is 500 ft. long, 30 ft. wide and 13 ft. deep, and there is a smaller tank 60 ft. × 5 ft. × 3·5 ft., in which either the models or the water can be moved, an 80-H.P. pump providing for the latter arrangement. The lines of the wax models are cut in a shaping machine, which can deal with models up to 25 ft. long and 3·6 ft. wide.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

A Safety Automatic Switch and Plug.

The Foster Engineering Co., Ltd., of Wimbledon, have recently introduced a patent automatic switch and plug for use in dangerous situations, such as coal mines, magazines, bunkers, &c.

The switch, fig. 2, contains an electromagnet so arranged that it holds in the "on" position the double-pole switch when current is passing through it, but should no current be flowing the magnet ceases to be energised, and the circuit is broken. The socket fig. 1, also contains an electromagnet so arranged that when current is passing through it, a small bolt is lifted, which locks the movable plug so that it cannot be withdrawn while the current is on. The magnets in both switch and plug are in series with the rest of the circuit.

Fig. 2.—Automatic Switch (Cover Removed) Showing Operating Key.

By the use of this apparatus, it is impossible to insert or withdraw the plug from the socket while the latter is alive, and any accidental breakage in the continuity of the circuit, due to a broken lamp, &c., instantly causes the double-pole switch to open, the whole of the wiring in the dangerous area thereby being made dead.

It will be seen from fig. 4 that one light only is controlled by each plug, and the circuit can only be used when *everything* is in thorough working order.

Magnetic Brake.

We illustrate in fig. 3 a magnetic brake by the Witton-Kramer Electric Tool and Hoist Co., of Birmingham, which is self-contained, and can be readily adapted to the existing couplings of electric motors and machinery.

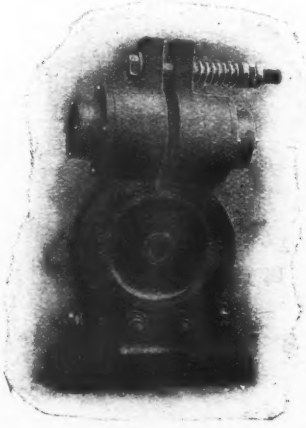


Fig. 3.—Witton-Kramer Magnetic Brake.

The brake shoes are leather-lined and adjustable; either shunt or series magnets are fitted—the latter arranged to open when half the full-load current of the motor is reached. A mechanical attachment for opening the shoes can be supplied in addition, if desired.

The device is supplied for 6, 8, 10 and 15-in. diameter pulleys.

Fig. 1.—Automatic Plug.

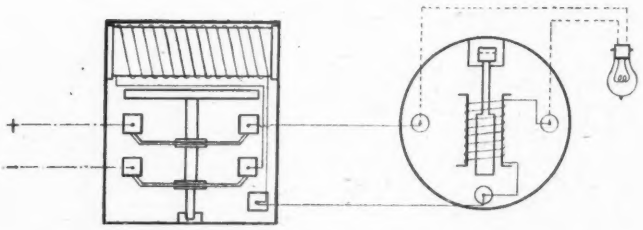


Fig. 4.—Circuit Diagram, Automatic Switch and Plug.

Enclosed A.C. Circuit-Breakers and Star-Delta Starters.

Mr. George Ellison, of Wharstone Lane, Birmingham, has recently introduced two new switches suitable for power purposes, of which the following are particulars :—

In fig. 5 is shown a triple-pole "Mill" type circuit-breaker, constructed in 50 and 100-ampere sizes for pressures up to 650 volts.

The case is watertight, and the cover interlocked with the switch ; there are two handles—one for closing the switch, and a smaller one for tripping it—and no-volt and overload releases and adjustable time-lags can be fitted.

The Mill type breaker is designed to take the place of triple-pole switches and fuses, and should be found useful in factories using slip-ring three-phase motors controlled by a plain rotor starter,

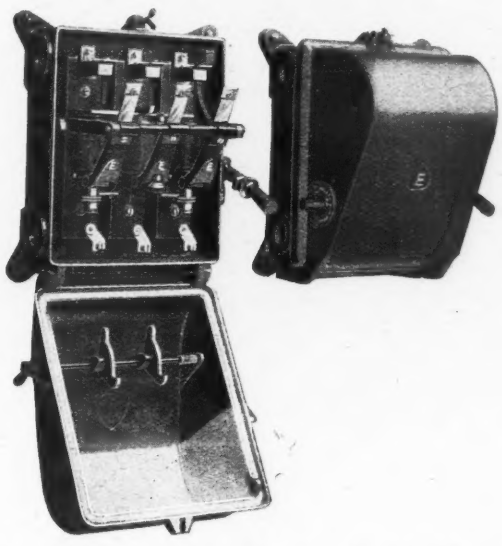


Fig. 5.—"Mill" Type Circuit Breaker, Open and Closed.

and combined switch and fuses. By dispensing with the latter, and substituting the Mill type breaker, there is (1) a saving in time and labour, owing to dispensing with fuses ; (2) no voltage as well as overload protection is obtained ; and (3) an emergency release if desired.

These breakers can also be utilised for starting up squirrel-cage motors thrown direct on the line, the heavy starting rush being

Fig. 6.—"Star-Delta" Switch for Squirrel-Cage Motors.

coped with, either by holding down the overload release trip handle, shown on the left of the illustration, or by fixing an adjustable time-limit device.

The oil-immersed "Star-Delta" switch for squirrel cage three-phase motors (illustrated in fig. 6), is especially suitable for colliery work. In many types of these switches now on the market, considerable trouble has been caused owing to there being no device fitted to prevent the operator throwing too quickly from the star to the delta position, or putting the handle into the running position before the start, or leaving it at the starting side.

These switches, however, are all fitted with the patent "Gradatim" safety device, which prevents operation except in the correct sequence.

Overload and no-voltage release and time-lag devices are fitted also an ammeter, as required.

These starters are also made in 50 and 100-ampere sizes, for up to 600 volts ; when in the "off" position they cut off the supply on all wires from the motors, consequently separate switches are unnecessary. We may add that we have seen them in use in the Midland Railway Co.'s Locomotive Works, Derby, of which some particulars recently appeared in our pages.

Holophane Lamp Reflectors.

Messrs. Drake & Gorham, Ltd., of 66, Victoria Street, S.W., have recently placed on the market a line of household Holophane reflectors, in several pleasing designs. Two of these are illustrated

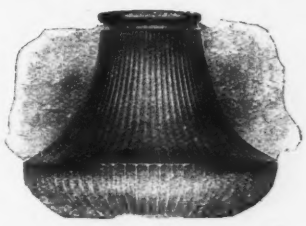


Fig. 7.

in figs. 7 and 8, for which it is claimed that they are much superior to those at present in use.

Messrs. Drake & Gorham are supplying a number of special designs of reflector fittings. One of these, known as the "Diamond Phœnix" lantern, is suitable for four lights (50-c.p. Osrams).

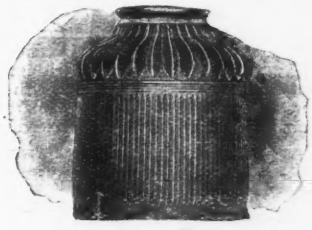


Fig. 8.

While retaining all the usual features of the "Phœnix," this type is somewhat more compact, and is particularly suitable for exposed positions. The top half of the shade is opal, and the disk acts as a

Fig. 9.—"Onelite" Reflector.

reflector. We illustrate in fig. 9 the firm's "Onelite" reflector, which is designed for one high candle-power lamp. It is made in four sizes, in zinc, enamelled green and gold.

The MacDonald Submersible Motor.

Some years ago we gave a brief description of a submersible electric motor invented by Mr. W. R. MacDonald, the patentee of a magnetic scrubber for ships' bottoms. The motor is now being put on the market by a company styled Submersible Motors, of 23, St. Swithin's Lane, E.C., and is illustrated herewith. Fig. 10 is reproduced from a photograph of one of the motors coupled to a centrifugal pump, arranged to pour water on the motor ; the whole set was lowered into a tank of water and run with the motor submerged, the pump shown being capable of delivering 30,000 gallons per hour to a height of 30 ft. Fig. 11 shows how the motor and pump can be employed in unwatering a mine, the set being submerged and lowered as the water-level falls, while the delivery pipe is lengthened correspondingly. The suction pipe and strainer shown in the figure are not really necessary. The temperature of the motor windings being kept down by the water which circulates freely through the interior of the motor, the resistance is also prevented from rising, and thus a high efficiency is obtained, though the winding can be run at a high current density ; a small motor also is able to give out a very large output for its size.

The motor is, of course, of the induction type, with squirrel-cage rotor, and the latter is so designed that, in the windings, which are in no way protected from the water, the potential difference nowhere exceeds 1·5 volts, so that the water is not electrolysed.

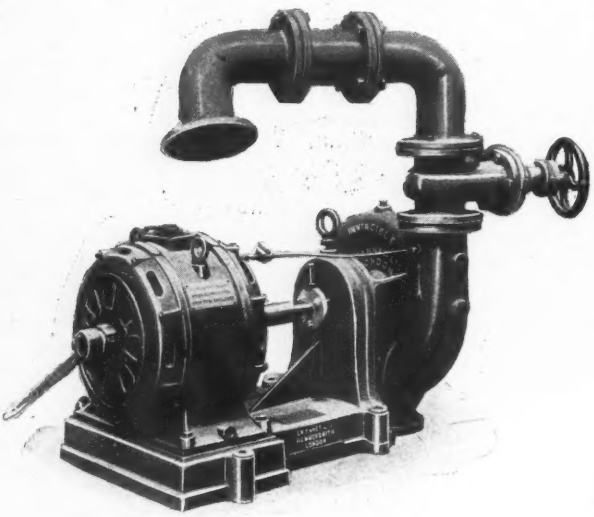


Fig. 10.—Submersible Motor and Pump.

The stator windings, on the other hand, are made wholly waterproof.

The machine, it is pointed out, is suitable for a very wide range of applications; it can be used to drive tools in damp or wet places, to work coal-cutting machines in fiery mines with safety (the motor being submerged in a tank of water, together with the controller), to pump water out of damaged water-tight compartments on board ship, to provide auxiliary pumping power on warships, to assist in

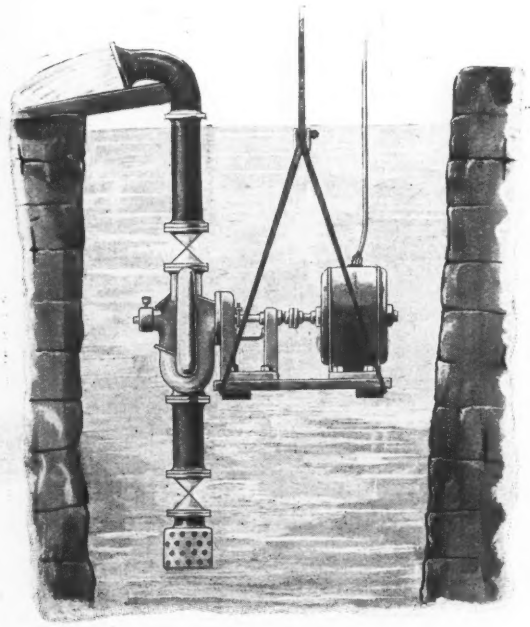


Fig. 11.—Submerged Motor Driving Pump.

salving wrecked vessels, and to operate tools under water, &c. An interesting application is to irrigation work in India and Egypt, where, in some cases, the water is derived from wells, the water level in which must not be lowered more than a certain distance; in these cases, the pumping set is simply lowered into the water to the specified depth and run until it ceases to draw, when it is hauled out and taken to the next well. By this means a large number of wells can be utilised at a minimum cost. Other uses will readily suggest themselves. We are informed that a motor of this type has been running under water for about six months without giving any trouble.

New Cooking and Heating Apparatus.

Messrs. F. A. Wilkinson & Partners, Ltd., of Harpenden, Herts., have just brought out a rapid electric heater, consisting of a polished aluminium casing, tray and expanded-metal top, as shown in fig. 12, with a novel heating element in the form of an earthenware ring through which the wire coil, working at bright red heat, is threaded. The power consumed is 600 watts, and an exceptionally high efficiency is claimed for the device, which boils three pints of water in 23 minutes. Ordinary household utensils are employed. The diameter of the apparatus is only 5½ in. In a

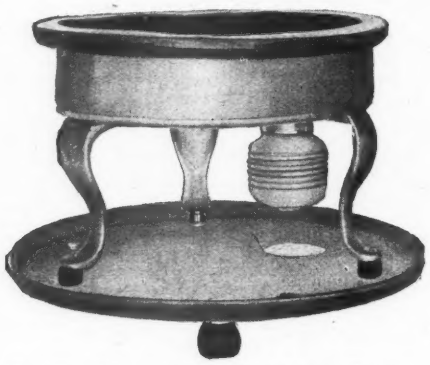


Fig. 12.—Economic Electric Rapid Heater.

test carried out at Faraday House, 2½ pints of water in a tin-plate kettle, at 63° F., were brought to the boiling point with an efficiency of 68 per cent., which is equal to the efficiency of some self-contained electrically-heated utensils.

Fig. 13 shows a modification of the same firm's Economic electric oven, forming a combined grilling, toasting and boiling range and oven; its dimensions are 12 × 12 × 17 in. high. The bottom

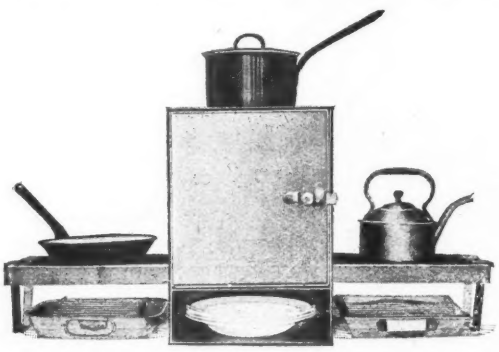


Fig. 13.—Economic Combined Grilling, Toasting and Boiling Range and Oven.

heating element is fitted into a metal tray sliding into the side and resting on the bottom of the oven. When the slide is withdrawn, water can be boiled on the top of the element, and grilling and toasting simultaneously carried on beneath. An additional slide element is supplied for resting on the top of the oven, to obtain a top heat for browning purposes and also for boiling liquids.

G.E.C. Home Office Fittings.

In the new catalogue of shock-proof accessories, the issue of which by the General Electric Co., Ltd., we alluded to recently, there are several interesting lines, designed to meet Home Office requirements, which may be brought to the notice of our readers. Among these is a two-pin wall plug (fig. 14) made especially to withstand severe usage and rough treatment. It is provided with a

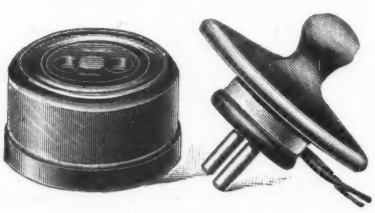


Fig. 14.—G.E.C. Wall Plug and Socket.

registered form of hand shield and handle, whereby the flexible cord in no case passes through the hand of the user, thus rendering personal injury impossible, even if the plug is inserted on a dead short. The flexible cord is not bent at right angles on entering the plug top, and it is only possible to withdraw the plug by using the handle protected by the shield, not by pulling the flexible cord. The socket tubes are fitted to the terminal plates by a new method giving additional contact surface, and ensuring perfect contact.

Fig. 15 represents a Home Office shielded fuseholder on a china protected base, with terminals and clip contacts. A line of ironclad wall plugs of the "Maritime" watertight pattern may also be mentioned; the base of the plug is fitted into a cast-iron case, and

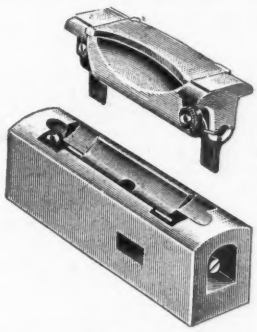


Fig. 15.—Shielded Fuse-Holder.

provided with screwed iron cover to base and plug top, to render the apparatus watertight, whether the plug is inserted or not. Earthing pins are provided, and the plug cannot be removed by pulling the flexible cord. In fig. 16 we illustrate a detachable ceiling rose, in which the removable cover carries the flexible, also the

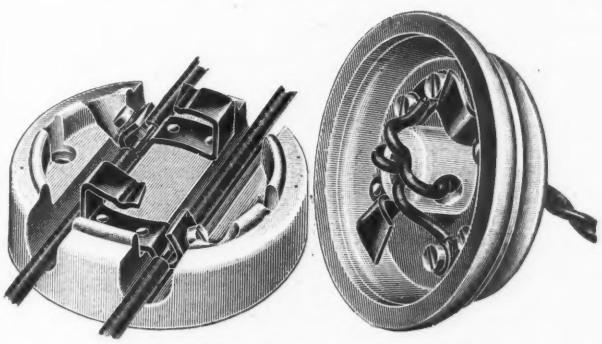


Fig 16.—G.E.C. Detachable Ceiling Rose.

fuse terminals where these are required. This admits of the wiring being carried out at the workshop or bench, and the ceiling rose cover, flexible and lampholder, are put into position by a half turn in a few seconds. The terminals in the base are so arranged that it is unnecessary to cut the main leads, which pass straight through.

Swivel Ball Bearings.

The Unbreakable Pulley and Mill Gearing Co., Ltd., of West Gorton, have recently acquired the sole right in this country to apply the Skefko swivel ball bearing to line shaft fittings and gear. The Skefko ball bearing was described and illustrated in our issue of October 7th last; it is provided with a double track, and in this way it is claimed that the load is distributed over three balls by the sperical outer race. The Unbreakable Pulley Co. have hitherto hesitated to recommend the application of the ordinary single-track rigid type of ball bearing to line-shaft work, but in view of the swivelling action and other advantageous features of the Skefko bearing they are now incorporating it in their bearings for line shaft and other work.

BUSINESS NOTES.

Book Notices.—*Report on the Pittsburg Transportation Problem.* By Bion J. Arnold. Pittsburg: From the author.—This report, the result of instructions from the Mayor of Pittsburg in January last year, embodies the data collected and the conclusions arrived at by Mr. Arnold in connection with the local passenger transportation problem of the Pittsburg district. That this is an extremely difficult problem is made clear by a view of a model showing the steep gradients met with on almost every route from the centre of the city outwards. The author has tackled it with extraordinary vigour, and in his report, which is prefaced by a summary of the contents, he discusses the matter exhaustively, with the aid of numerous maps and diagrams, comparative data from other cities, &c., the whole forming a work of permanent value, and occupying about 200 pages.

The Green Book of London Society. Edited by Douglas Sladen and W. Wigmore. London: J. Whitaker & Sons, Ltd. Price 5s. net.—This is a new edition, for the year 1911, of a book to which we referred at the time of its first appearance. We are afraid we cannot say much about it that will interest the electrical reader, as such. To quote its own description, it is "a Directory of the Court, of Society, and of the Political and Official World; including celebrities in art, literature, science and sport, with many other subjects of current interest." As to the bulk of it, it appears to consist of a directory of British titles, and a directory of peers, peeresses, and peers' eldest sons, archbishops, privy councillors, members of Parliament, and so on. May it not be of inestimable value when we draw up the list of those 500 peers—even though it be merely as a guide whom to avoid!

"*Journal* of the Institution of Electrical Engineers." Vol. 46, No. 205. London: E. & F. N. Spon, Ltd.—The February issue contains the following papers:—Inaugural Address, by S. Z. de Ferranti; "Street Lighting by Modern Electric Lamps," by H. T. Harrison; Chairman's Address, Newcastle Local Section, by C. F. Proctor; Chairman's Address, Manchester Local Section, by J. S. Peck; Chairman's Address, Glasgow Local Section, by S. Mavor; Chairman's Address, Yorkshire Local Section, by T. H. Churton; Chairman's Address, Birmingham Local Section, by M. J. Railing; "Irregularities in the Rotating Field of the Polyphase Induction Motor," by C. F. Smith; "Inherent Speed Regulation of the Direct-Current Shunt Motor," by E. W. Short; "Electric Winding," by G. Stjernberg; "The Testing of Transformer Iron," by L. W. Wild.

"A Treatise on Transformers." By Hermann Bohle and David Robinson. 1911. London: Charles Griffin & Co. Price 21s net.

"Constitution and List of Members of the American Society of Civil Engineers." February, 1911. New York: The House of the Society.

"The School of Mines Quarterly." Vol. XXXII, No. 2. January, 1911. New York: Columbia University. Price 50 cents.

"Boletin de la Sociedad de Fomento Fabril." February, 1911. Santiago: Moneda, 759.

"Atti della Associazione Elettrotecnica Italiana." February, 1911. Milan: Via S. Paola, 10.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXX, No. 3. March, 1911. New York: The Institute. Price $1.00.

"The Russian Year Book." 1911. By Howard P. Kennard. London: Eyre & Spottiswoode. Price 10s. 6d. net.

"A Handbook of Testing Materials." By C. A. M. Smith. 1911. London: Constable & Co. Price 6s. net.

"*Transactions* of the Illuminating Engineering Society." Vol. VI, No. 2. February, 1911. Easton, Pa.: The Society.

"The Rubber Country of the Amazon." By Henry C. Pearson. New York: The *India-Rubber World*.

Cascade Motors.—The Sandycroft Foundry Co., Ltd., of Sandycroft, near Chester, have forwarded to us a pamphlet giving details and illustrations of their single, two and three-speed "Cascade" motors; also a "Sandycroft Power Calculator"—a card device, with appropriate circular scales, for rapid calculations of H.P., current, &c., of alternating and direct-current motors; the calculator base represents a cascade motor carcase, and is adapted for standing on the desk or hanging on the wall.

Dissolutions and Liquidations.—Robinson and Mulliner, consulting engineers, Liverpool.—Messrs. A. E. Robinson, W. M. Horsfall and E. B. Mulliner have dissolved partnership, Mr. Mulliner having retired. The other partners will attend to debts and continue the business.

Cowper-Coles Copper Corporation, Ltd.—A meeting is to be held at 28, Victoria Street, S.W., on April 18th, to hear an account of the winding up from the liquidator, Mr. A. E. Tugwood.

Photo-Printing Paper.—The manufacture of "technical printing papers" for blue prints, black or brown on white, &c., has been taken up by the Technical Paper Co., at 26, Red Lion Square, London, W.C. Hitherto all such papers have been, it is stated, of Continental manufacture; the new undertaking will not only provide a supply of British-made papers, but will also remove some of the disadvantages attaching to many kinds, such as their perishable nature; the company will guarantee the durability of its products, and having put down a very large machine, claims to produce better paper at a lower price than its competitors.

British Tungsten Lamp Co., Ltd.—A petition for winding up this company has been presented by Messrs. T. McKenna and F. H. Harvey-Samuel (McKenna & Co., 31-34, Basinghall Street, E.C., solicitors) and the Metallfadenlampenwerk Berlin G.m.b.H., of Berlin. It is to be heard on March 28th, at the Law Courts.

The National Electrical Manufacturers' Association (Inc.).—We have received from the secretary a printed report of the proceedings at the sixth annual meeting, held on February 28th, when some 31 firms were represented, and Mr. H. W Butler presided. It was reported that during 1910 the membership had increased from 43 to 80, and since the close of the year three or four others had been added, practically doubling the membership. The successful efforts of Messrs. Longbottom, Dunlop and Grainger, the Northern Section Committee—and particularly those of Mr. Longbottom—were mentioned. Though they were considerably stronger, however, they would not be able to accomplish that amount of good which was desired until practically the whole of the manufacturers were enrolled, and Mr. Butler urged each member to secure one new one within the next few months. The question of objectionable clauses in specifications was touched upon, the chairman mentioning that a Standing Committee of members of the Incorporated Municipal Electrical Association and of the National Electrical Manufacturers'

Association, to whom all such points would be remitted. Concerning the Olympia Electrical Exhibition, there was little doubt that they would have a very successful show. Practically the whole of the ground floor had been let, and the total amount of the space-rent already exceeded that of the previous Olympia Exhibition. The Association Committee had been in negotiation with the Board of Trade with regard to a combined exhibit at the Turin Exhibition, but sufficient support was not forthcoming. He was sorry that this was so, because, in other trades, these combined exhibits had been enormously successful. At Brussels and in the Argentine the results in many trades had been exceptional. The following speakers were Mr. H. H. Berry, who seconded the adoption of the report of the Committee; Mr. F. H. Nalder, who reported nothing done since last year in regard to the Engineering Standards Committee; Mr. H. Bevis, who alluded briefly to the question of model general conditions of contracts, and said that the I.E.E. had decided to revise the conditions and publish them in such a form that they would appeal not only to municipal engineers, but to town clerks, who frequently had been responsible for onerous and unacceptable conditions. The new model conditions generally had been made more fair and reasonable, and they were now being printed. Manufacturers would find them more equitable from their point of view. Mr. B. Longbottom dealt with the formation of the Northern Section, which he said had served its purpose and need not be continued, as the various manufacturing sections of the Association would hold their meetings in Manchester, Birmingham and other places. Already the dynamo and motor section, the switchgear section, and the arc lamp section had done useful work, and he looked forward to their being exceedingly useful in dealing with trade grievances. Mr. Dunlop suggested that the secretary should have an assistant. This matter will be dealt with by the Council. The report was adopted, as were also the accounts on the motion of Messrs. H. C. Siddeley and T. J. Grainger.

Balloting then took place for members of the Council, and also of the General Committee, with the following result:—

Members of Council.

Berry, Skinner & Co.	International Electric Co., Ltd.
Brit. West. Elec. & M'f'g. Co., Ltd.	Lancashire Dynamo & Motor Co., Ltd.
Bruce Peebles & Co., Ltd.	A. & P. Lundberg & Sons
Electrical Power Storage Co., Ltd.	Nalder Bros. & Thompson, Ltd.
Electromotors, Ltd.	A. Reyrolle & Co., Ltd.
Elliott Brothers	Sunbeam Lamp Co., Ltd.
Ferranti, Ltd.	Vickers, Sons & Maxim, Ltd.
General Electric Co., Ltd.	

Members of General Committee.

Berry, Skinner & Co.	*Nalder Bros. & Thompson, Ltd.
Croggon & Co., Ltd.	Pirelli, Ltd.
Electrical Power Storage Co., Ltd.	Sterling Telephone & Electric Co., Ltd.
Electromotors, Ltd.	*Sunbeam Lamp Co., Ltd.
General Electric Co., Ltd.	Union Electric Co., Ltd.
International Electric Co., Ltd.	
*Lancashire Dynamo and Motor Co., Ltd.	

* These firms being members of the Council subsequently intimated their desire to be relieved of the work on the Committee, and Crompton & Co., Gilbert Arc Lamp Co., Ltd., and Hart Accumulator Co., Ltd., have been elected by the Council to fill the vacancies.

Mr. Dunlop asked if the secretary could make any report with regard to the possibility of some of the larger firms, who are not yet members, joining at an early date. He understood that a meeting was held a short time ago, which some of the larger firms attended. Was there any result? The secretary said that he was keeping in frequent touch with some of the larger firms, whom he had reason to believe would join in the course of time, but that large firms were slow to move in such matters. Mr. Longbottom mentioned that he had the promise of four more dynamo makers to join the Association.

Trade Announcements.—Mr. W. C. V. Cooke has started business as an electrical engineer at 104, Carolgate Bridge, Retford.

Messrs. Balcke & Co., Ltd., have taken larger offices, and after 25th inst. all communications should be addressed to Broadway Court, Broadway, Westminster, London, S.W. Telephone No., "Victoria 1387."

The Adams Manufacturing Co., Ltd., have lately concluded agency arrangements for their "Adams Igranic" motor-control apparatus with Messrs. Balmer, Lawrie & Co., of Calcutta, and Messrs. Greaves, Cotton & Co., of Bombay. Both of these firms will hold stocks of catalogues and literature and will deal with all local inquiries.

Messrs. Price & Co. have commenced business at 16, High Street, Newport (I.W.), as electrical engineers.

Messrs. Pope's Electric Lamp Co., Ltd., of Willesden, notify that they have appointed their Mr. Ernest A. Marx to be their sales manager.

In order to enable them to hold larger stocks of their "Sunbeam" lamps, accessories and electrical material, the Sunbeam Lamp Co., Ltd., have removed to larger premises both at Manchester and Bradford. In future the address of their former depôt will be 9, New Brown Street, Manchester (Telephone "2608 City"), and that of the latter, North Parade, Bradford, with stores at Northgate. At the Bradford premises (Telephone No. 5436) a showroom has been opened where the latest fittings and heating and cooking apparatus are open to inspection.

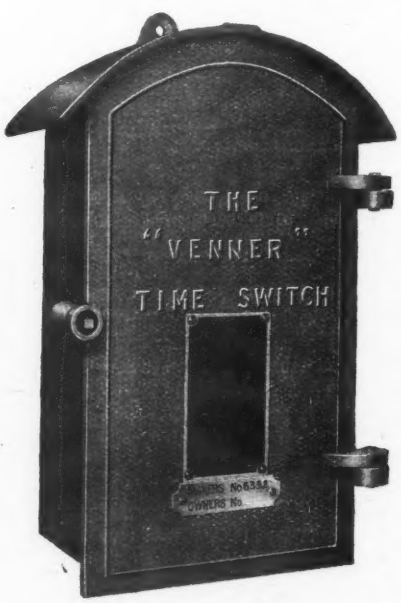
Exhibition.—There is to be an international exhibition of small mechanical plant from May 13th to July 13th, at Antwerp. It is organised by the Antwerp Small Mechanical Plant Syndicate. Full particulars of the rules, classification, committée and so forth, can be obtained from the Secretary to the Executive Committee, Longue Rue Neuve, 109, Antwerp.

Private Meetings.—F. Shalders and T. Davis, trading as Shalders & Davis, electrical engineers and contractors, Southampton.—A conference of some of the principal creditors of the above was held last week in London, when a statement was presented showing the position as at March 11th last. From this it appeared that the liabilities of the firm amounted to £7,343, made up as follows:—Unsecured creditors, £4,016; Capital and Counties Bank, Ltd., £3,027; and liabilities for dilapidations under lease, £300. The assets were estimated to realise £8,950, and there was thus an estimated surplus of partnership assets over liabilities of £1,607. In view of the fact that the statement of the partnership assets showed a large surplus, it had not been thought necessary to go into the private estates of either of the partners. It was pointed out that the meeting had been called at short notice as one of the largest creditors had commenced proceedings for the recovery of a debt of over £700. The object of conferring with the creditors was to consider the best means to be adopted for paying the creditors in full. A suggestion was made that the debts should be paid by four equal quarterly instalments to be secured by the issue of a first mortgage debenture to trustees over all the present and future assets, which are to be sold to a private limited company, who are to undertake to pay and discharge the liabilities. The partners were also not to be released from the present debts until the creditors had been paid in full. After a short discussion, the meeting unanimously agreed to these suggestions provided the execution creditor withdrew on payment of costs. Mr. G. G. Poppleton was appointed to act as trustee on behalf of the creditors, while Mr. W. C. Westlake was nominated for a similar position by the bank. It was stated that the company to be formed to take over the business would have three directors, and would consist of the two partners and the principal creditor, while a committee was also appointed consisting of the representatives of the National Radiator Co., the Ediswan Co., Messrs. Russell & Co., the Capital and Counties Banks, and Mr. Hands.

Coronation Illuminations.—For the interest of those who are looking out for electrical business in this connection, we would draw attention to a further list of tradesmen holding Warrants of Appointment to the Queen in the *London Gazette* for Tuesday last (March 21st).

For Sale.—Messrs. Percy Huddleston & Co. will, on Wednesday and Thursday, March 29th and 30th, sell by auction a large quantity of electrical apparatus. See our advertisement pages to-day.

Time Switches in China.—It is exhilarating to converse with those business men who have long declined to confine their efforts to these rock-bound isles and thus have either gone themselves or sent their qualified envoys to fetch the orders home from other lands. Sometimes these enterprising spirits are tempted to wonder whether it can be true that others are asleep while they are doing so well as the result of their outgoing. Undoubtedly the most prosperous and the most hopeful among us are those



whose correspondence and whose thoughts are as to a good proportion occupied with their enterprise abroad. We are always glad to receive reports and paragraphs giving a lengthy list of business lately booked or orders recently executed for electrical enterprises in other lands, and we believe these statements are of equal interest to our readers. We have gone so far at times as to publish illustrations of publicity posters which lampmakers have adapted in the language of their letterpress to the needs of Russia, China, and so forth. Generally speaking, we think that a lot of space can be

uselessly expended in reproducing poster pictures in editorial pages, but having once shown a Chinese lamp poster we cannot refuse hospitality to the accompanying picture which we show as an illustration of the wide-awakeness abroad of a firm of time switch and meter makers. We mention as an interesting fact, and not as an advertisement, that the Venner time switches are being used in practically every civilised country in the world, so that if in the future you come across a country where the people have been in such gross darkness as to ignore it, this act alone is the mark of their uncivilised condition. It is becoming more difficult nowadays to say who are the uncivilised nations, so it is as well to have a clue of this sort. Is China civilised? In parts of course. Shanghai, for instance, takes a good supply of these time switches from Messrs. Venner & Co., and we show one of these of a particular type in watertight case for outdoor use, which bears the Chinese label. From South Africa repeat orders are being continually received, and from Messrs. Crompton & Co., Ltd. an order for 125 switches for the public lighting in Sydney, New South Wales, was received some time ago. But these are only examples of what the firm are doing—we have not space to mention others.

Canadian Electrical Purchases from U.S.A.—An American Consular report states that Canada purchased from the United States in the eight months ended November 30th, 1910, electric insulators, batteries, and telephone and telegraph instruments valued at $2,417,569, and only $53,209 from all other countries.

Osram Rinkers.—To represent "Electric Light" by decking oneself out in Osram lamps and Osram literature seems to be a popular way with competitors at fancy dress rinking carnivals. The success of such a competitor at Carnarvon recently makes the tenth instance during a few weeks in which success has been won in this way.

Bankruptcy Proceedings.—V. G. Burkitt, electrical engineer, 38, Park Row, Bristol.—March 31st is last day for receipt of proofs for dividend by Mr. C. H. King, Official Receiver, 26, Baldwin Street, Bristol.

Edward Surtees, electrician, 22, King Street, South Shields, Durham.—The adjourned public examination of the above debtor took place at the County Court, Westgate Road, Newcastle-upon-Tyne, last week, when the debtor was allowed to pass.

J. W. Barnett (Barnett & Hyde), electrical engineer, Burslem.—A first and final dividend of 1s. in the £ is payable March 29th. Official Receiver's office, King Street, Newcastle, Staffs.

LIGHTING and POWER NOTES.

Aberdeen.—For some time the Corporation Lighting Committee has been experimenting in Albyn Place with the metal-filament lamps, and three weeks ago it fixed 10 Osram clusters, each of three 50-c.p. lamps. The gas department, feeling that its province was being invaded, immediately set about showing what improvements could be effected by the use of gas, and experiments of various systems of lighting which are being made in Queen's Road and Fountainhall Road were inspected last week by a Lighting Sub-Committee. The result of the contest between gas and electricity is awaited with much interest. In a week or two information will be submitted, showing the relative cost and maintenance of the lamps.

Ashton-in-Makerfield.—The B. of T. has given notice of its revocation of the Ashton-in-Makerfield Electric Lighting Order, 1901, which was confirmed by the Electric Lighting Orders Confirmation (No. 6) Act, 1901, as to the whole area of supply, as from March 7th, 1911.

Brierley Hill.—The B. of T. has revoked the 1900 E.L. Order.

Belfast.—At the fortnightly meeting of the Tramways and Electrical Committee, Mr. Bloxam submitted a report on the recent Electrical Exhibition, which contained the following:—The city accountant has prepared a balance-sheet, showing the actual deficit resulting from the Exhibition, which represents the actual cost of the valuable advertisement to the department which it has provided, and which amounts to £311. The total expenditure was £616. A total of 12,694 visitors, or about 1,000 per day, may be considered a highly satisfactory attendance. Inquiries amongst the exhibitors disclosed the fact that all, without exception, were more than satisfied with the orders they had secured. Certain exhibitors covered their expenses by sales effected during the first few days alone. The number of applications for a supply of electricity that have been made to the department since the Exhibition, and directly traceable thereto, is very gratifying. I have no hesitation in stating that, although there is an excess of expenditure over receipts of approximately £311, the Electrical Exhibition, as an advertisement not only to the electricity department and the local contractors, but also from an educational point of view, has been well worth the labour and expenditure incurred.

Burnley.—The Electricity Committee has decided to reduce the charge to consumers of current for lighting purposes, from 3½d. per unit, less 5 per cent. discount, to 3d. per unit, less 5 per cent. discount. The charge for current required by the Tramways Committee for traction, is also to be reduced from 1·25d. to 1·2d. per unit.

Caversham.—The U.D.C. has decided to invite the Reading and District Electric Supply Co., Ltd., to tender for lighting the whole or any part of the town.

Continental Notes.—Austria-Hungary.—The Bodencreditanstalt (Land Bank) and the Credit Anstalt are concerned in a scheme to provide cheap power. The two banks propose to erect a large central electric generating station—"the first of its kind," it is said—at Rossitz, near Brünn, near coal mines belonging to the first-named bank, and supply electric current to the numerous industries lying around Brünn. The station will draw cheap coal supplies from the mines, while the latter will be benefited by the facilities afforded to profitably utilise their by-products. It is pointed out that such combinations have proved exceedingly profitable abroad, and particularly in Germany, where their operations have undergone constant extension.—*Elektrotechnik und Maschinenbau.*

The "support home industries" movement has spread to Austria, a recent invitation for tenders for the supply of light and power equipment of the State railway works at Knittelfeld having appended the stipulation that the successful tenderers would be pledged to use only materials of Austrian manufacture.

Roumania.—The German Vice-Consul at Craiova reports that there is a very good future for the sale of material for water-works and electric generating plants, as there is an increasing desire on the part of even the smaller towns to have up-to-date water systems and electric lighting.—*Board of Trade Journal.*

Croydon.—The B.C. has decided, that subject to consumers entering into a three years' agreement, electric current for outside shop lighting shall be charged 3d. per unit.

Dawlish.—At a recent meeting of Devon C.C. an application was received from the Dawlish D.C. for an order dispensing with the prohibition with regard to voting in respect of certain members of the Council who are shareholders of the Dawlish Gas Co. and the Dawlish Electric Light Co. The clerk explained that the Dawlish Council had 11 members, and all but three were disqualified through being shareholders in the two companies. The chairman said he did not suppose there was any objection to the removal of the disqualification, and it was agreed that the matter be referred to the General Purposes Committee.

Ealing.—The T.C. has decided to supply current for Coronation illuminations at 1½d. per unit, plus out-of-pocket expenses for connecting up, &c., and other special services.

Fleetwood.—Comment has been caused as to the increased cost of public lighting, and the electrical engineer, Mr. Miller, has presented a report showing that, from January to December, 1909, the illuminating power of public lamps was 9,132 c.p., the cost of energy being £1,046, while from January to December, 1910, the candle-power was 38,200 and the cost was £1,732. During 1909 the Council paid for every 100 c.p. a sum of £11 10s., while during 1910 the cost per 100 c.p. was only £4. After April 1st the current for street lighting is to be charged at the rate of 3d. per unit.

The extensions at the electricity works were formally opened on March 16th, when a number of Councillors and officials of neighbouring authorities assembled at the invitation of Councillor G. M. Robertson, who started the new engine.

Fiji.—The Fiji *Royal Gazette* of November 4th publishes a memorandum as to the conditions under which the Government would be prepared to grant a concession conferring exclusive rights to any corporation for a period of 25 years to supply electricity to the public for lighting and power purposes, and to establish and work an electric tramway, within a radius of 5 miles from the Post Office, Suva. The *Gazette* may be seen by British firms at the Commercial Intelligence Branch of the B. of T.

Glasgow.—The improved lighting of the central section of the city is at present under the consideration of the Watching and Lighting Committee, and with a view to experimenting, 30 of the latest type of "flame" arc lamps have been secured on loan from three different manufacturers. These have been erected in Jamaica Street, Renfield Street and Argyle Street, while five of a smaller type of "flame" arc lamp have been installed in George Square.

The T.C. has been asked to consider a proposal to promote a smoke abatement exhibition during next winter, and to remit to a Special Committee of members from the Health, Gas and Electricity Committees to make all necessary arrangements for such an exhibition.

Hastings.—The L.G.B., in giving sanction to a loan of £2,085 in connection with electric lighting extensions, for the authorised period of 25 years, expressed the view that before a new main was laid the Corporation should satisfy itself that a proper and remunerative revenue would be received from it, and that it must impress upon the Council the importance of carefully considering the question from a financial point of view. At the L.G.B. inquiry held recently the application was strongly opposed by counsel on behalf of the local gas company.

The T.C., on Friday last, adopted a recommendation of the Public Lighting Committee, by which 250 gas lamps are to be replaced by a similar number of electric lamps. This is following the policy of previous years, a certain sum being allocated annually out of current rate for conversion of gas lamps in streets where electricity mains are laid. The L.G.B. refused a loan originally asked for, and thereupon the Council decided to do the work by annual instalments.

Ipswich.—The B. of G. has declined to entertain a proposal that electricity for lighting the workhouse should be taken from the Corporation, as the Board has its own installation. The Board has, however, decided to ascertain if a supply of current is available for lighting St. John's Home.

Larne.—The Urban Council has authorised its Sub-Committee to secure the services of expert engineers (*a*) to furnish a report on the matter of the electric lighting of the town generally; (*b*) to report on the question of purchasing the Larne Electric Light Works, Ltd., and (*c*) to submit such facts as will enable the Finance and Lighting Committee to decide how the various interests of the district may best be served in the matter of lighting.

Leominster.—The promoters of the E.L. Order, Messrs. Seymour & Co., have written to the B. of T., asserting that the T.C. was acting in an arbitrary manner in regard to their scheme, and asking the Board to dispense with the Council's assent. The T.C. has decided to reply that it consents to the scheme on condition that the compulsory area is enlarged so as to include certain additional thoroughfares in the borough.

Liverpool.—The Tramways and Electricity Committees, accompanied by Mr. C. W. Mallins (general manager of the tramways), Mr. J. A. Brodie (city engineer), Mr. A. Bromley Holmes (consulting electrical engineer) and Mr. A. Clough (resident electrical engineer) have made their annual survey of the electrical and tramway undertakings, visiting the Lambeth Road Tramway Construction Works, Carisbrooke Road car-shed, Rice Lane generating station, Lister Drive power station, the Toxteth generating station, Smithdown Road car-shed and the Highfield Street works and offices.

London.—Poplar.—An offer has been made by the Limmer Asphalte Co. to provide a building on the premises of the company at Orchard Place suitable for housing two 250-kw. motor-converters with the necessary switchgear, and to furnish, as far as practicable, the necessary attention to the plant by way of starting up, shutting down, and regulating the load during working hours. The company agrees to give the Council possession of the proposed sub-station building for 7, 14 or 21 years at a nominal rent of £15 per annum. The Committee considered that the proposed arrangement would be an advantage to the undertaking for some time to come, as with two converters running, the whole of the demand in this neighbourhood could be met, and the present expensive method of boosting the feeder at the main station obviated, while the network near the Iron Bridge and that part of the East India Dock Road would be considerably strengthened. The estimate was £4,767 (mains £2,525, and plant £2,242). The annual consumption of the Limmer Asphalte Co. will probably amount to 500,000 units, producing an income of approximately £1,500. The proposed extensions are to be carried out subject to satisfactory arrangements with the Limmer Asphalte Co. for the provision of the proposed sub-station. Competitive prices are to be invited for the supply and erection of the converting plant. Provision is to be made for expenditure out of revenue during the financial year to end March 31st, 1912, to meet the cost of connections of consumers to mains and supply of meters estimated at £1,250, and 50 wiring installations estimated at £750.

Stepney.—In January, 1909, the Council instructed the Electricity Committee to formulate a scheme for putting into operation the provisions of Part V of the L.C.C.'s (General Powers) Act, 1906, dealing with the supply of electric fittings. Owing, however, to insufficient margin of generating plant, the Committee deferred the matter from time to time. Now, however, the electrical engineer and manager has submitted to the Committee a long communication upon the matter, in the course of which he suggests that the scheme should include:—(*a*) The hire and maintenance of apparatus; (*b*) the hire-purchase of apparatus and wiring; (*c*) the cash purchase of apparatus; and (*d*) the cash purchase of apparatus and wiring. With regard to these he proposes:—(*a*) That such apparatus as electrical heaters, flatirons, kettles, cookers, arc lamps, motors, &c., should be hired out to consumers, and be maintained at reasonable monthly rentals; (*b*) that in cases where suitable wiring does not already exist, the Council (except in minor cases which cannot be conveniently tendered for) to provide the wiring through qualified contractors, the Council itself providing the necessary apparatus. The consumer to pay by instalments on a hire-purchase agreement over periods not exceeding three years; (*c* and *d*) that in cases where a consumer prefers to purchase outright apparatus and wiring other than incandescent lamps, the same be paid for at the one year's hire-purchase rate, less 5 per cent. cash discount, the Council maintaining such apparatus and wiring for one year after date of connection. Incandescent lamps to be sold at the published prices without guarantee or maintenance. Turning to the financial side of the scheme, he recommends that £500 of the existing surplus of the undertaking be allocated for this purpose.

Hackney.—For the year ending March 31st next, the electricity department is expected to yield a surplus of £8,791, and in view of the substantial amount standing to the credit of the reserve fund, the Finance Committee recommends that £4,702 (equal to 1d. in the £) shall be transferred to the credit of the general rate for the year ending March 31st, 1912.

St. Pancras.—The Finance Committee reports further communication from the L.C.C. regarding the period of 42 years allowed for repayments of electricity loans. The L.C.C. notes that out of the surplus for 1909-10, £7,960 was applied in reduction of the rates, and it urges the B.C. to come to an arrangement with it, for the repayment by instalments of the whole of the outstanding annuity debt for electricity purposes. This the Finance Committee is unable to agree to.

Lytham.—A new electric lighting company is being formed with the object of placing an installation in Lytham. Half the capital has already been subscribed, and it is intended to ask the residents of the town to subscribe the other half.

Oldham.—The T.C. has decided to have the Westhulme Hospital wired and fitted up for electric light.

Paisley.—The contemplated electrical exhibition has received such poor support that the Electricity Committee has agreed to abandon the idea. A canvass was made of proprietors likely to introduce electricity into their houses, with poor results, and, as the engineer reported that similar exhibitions in other towns had resulted in heavy loss, the project was considered hopeless.

Sevenoaks.—A B. of T. inquiry was held on March 9th relative to the application of the U.D.C. for a prov. order for electric supply. The gas company and the South-Eastern and Chatham Railway Co. were amongst those who opposed, but it was intimated that the order would be granted.

South Africa.—A recent visit of the South African Association of Engineers, chronicled in the *Australian Mining Standard*, was to the Central mill and mines of the Randfontein Estates. The mill—claimed to be the largest in the world—deals with the output of five mines, and contains 600 stamps, arranged in groups of 20, each driven by a 100-h.p. motor. The tube mill adjacent contains 10 10-in. centrifugal sand pumps, driven by 125-h.p. motors, and 16 tube mills driven by 100-h.p. motors. The slime plant also includes three 12-in. centrifugal, and two 10-in. and three 11-in. turbine pumps for circulating and discharge purposes. Each of the five mines is equipped with an electric winder with Ward-Leonard control. The winding drums are each operated by two 350-h.p. direct-current motors supplied from an 800-h.p. motor-generator set. The whole plant is supplied from a mine power station equipped with two 1,000-kw., three 2,000-kw. and two 6,000-kw. turbo-alternators generating 6,600-volt three-phase 50-cycle current, which is distributed by duplicate cables to various sub-stations. The standard transformer used in the sub-stations is of 500-k.v.a. capacity, and some 15,000 k.v.a. of transforming plant is in use.

Stafford.—The T.C. has revised the charges for current for power as under:—Up to 200 units per quarter, 2¼d. per unit, less 2½ per cent. discount; over 200 units and up to 10,000 units per quarter, 2¼d. per unit less 50 per cent., with a minimum payment of £2 per quarter; beyond, an extra 20 per cent. discount.

Swanage.—At the meeting last week of the Council, a communication from Mr. F. Swarbrick, of Leigh, Lancashire, was read, soliciting the support of the Council for a scheme for establishing an electric supply undertaking. In the event of the Council not being prepared to take up the scheme, the writer asked that it should not oppose any scheme, as he would be open to promote a company to carry it out. It was decided by the Council to write to Mr. Swarbrick for further details of the projected scheme.

Truro.—In sending a cheque in payment of the fees in connection with the proposed E.L. order to the T.C., Messrs. Purves, of Exeter, have intimated that they hoped to take up the subject of E.L. with the Corporation early next Session.

Venezuela.—American Consular reports state that the new electric light plant for the city of Valera has been completed, and was to commence working early this month. The installation was supplied from the U.S.A.

Wakefield.—The T.C. has decided to extend the mains, &c., at a cost of £2,106, so as to supply current to Messrs. Cradock and Co., Ltd.

Watford.—The U.D.C. has decided, subject to the consent of the B. of T. and the Bushey U.D.C. being obtained, to extend the mains so as to supply current to the works of Messrs. André & Sleigh, at Bushey Grove Road.

TRAMWAY and RAILWAY NOTES.

Australia.—The Spit-Manly extension of the Sydney tramway system was formally opened on January 9th. The main feature of the new line is that the power, which is derived from the Ultimo power house, is carried by high-tension overhead transmission lines across Middle Harbour. This route practically completes the tramway system right round Sydney Harbour, from the North to the South Head.

Birmingham.—Work in connection with the conversion of the cable tramway from Colmore Row to Hockley Brook, for electrical working, has now been commenced. The tramway company's lease expires on June 30th, and it is hoped to start an electrical service immediately after that date. Beyond Hockley Brook the line belongs to the Handsworth Council, which has, so far, made no move towards electrifying its section of the route.

Bradford.—The T.C. has referred back to the Tramways Committee, for further consideration, the proposal to provide a central tramway depôt, at an estimated cost of £46,500.

Canada.—According to the *Financier*, negotiations have been started for the acquisition by Winnipeg T.C. of the street railway. Sir W. Mackenzie, the president of the company, appears to be anxious to sell. There has been much litigation between the city and the company. The cost of the entire plant is represented to be $14,000,000 (about £2,806,000).

Cheshire.—On Tuesday the Light Railway Commissioners opened an inquiry at Nantwich into an application for power to construct a light railway from Mouldsworth to Nantwich, a distance of 18 miles. The scheme was opposed by Mr. Pollard, K.C., for Lord Tollemache's trustees, and Mr. Ralph Brocklebank, through whose estates the proposed route passes, and by Mr. Coward, K.C., on behalf of the London and North-Western Railway Co.

Clayton-le-Moors.— Regarding the application for Clayton-le-Moors Light Railway Order, the Town Clerk of Accrington has been informed that arrangements have now been made between the promoters and the L. and Y. Railway Co., whereby they now ask that the order should be granted to the railway company. The Commissioners have decided to grant the application. The Commissioners are to frame a provisional draft for the consideration of the Accrington Corporation before the order is finally settled for submission to the B. of T. for confirmation.

Continental Notes.—France.—Several electric tramway schemes are projected in various parts of France. Cherbourg has definitely decided to convert its existing steam tramways to electric working. At Périgeux the concession granted to M. Prugneau in 1901, is being taken up again. The Nancy T.C. is about to spend half-a-million francs on extensions of its network. M. Baru has obtained a concession for electric tramways to be laid from Valence to St. Peray, in the Department of the Drôme, and a syndicate is seeking powers for the establishment of a tramway system between Port de Bouc, Saint Antoine and Martigue, in the Bouches du Rhône department.—*Revue Pratique de l'Electricité.*

Germany.—It is officially announced that the Government has definitely abandoned its scheme for the construction of a fast electric railway from Köln (Cologne), after careful investigation and the hearing of evidence.

Halle-on-the-Saale has decided to expend 4 million marks on the purchase of its tramways, and the enlargement of the generating station.

Official approval has been announced of the projected district central station to be built at Seesen, in Brunswick, to supply some 45 rural localities. The Electricitäts A.G. vorm. A. Poge, of Leipsig, are the concessionaires.

Austria.—The Ministry of Railways has authorised the T.C. of Salzburg to make the preliminary studies for an electric tramway system in that city, with an extension to Maxglan.—*Der Elektrotechniker.*

Russia.—Plans have been submitted to the Russian Committee for new railways by (1) Messrs. Tchaeyv and Kapdaurov for the construction of an electric railway from Baktchisarai *via* Yalta to Alushta, with branches to Yalta harbour and to Semeis; and (2) Mr. G. K. Ushkov for the construction of an electric railway from Sevastopol to run in a southerly direction, passing through Lasp and Alupka to Alushta.—*Board of Trade Journal.*

Belgium.—La Société des Tramways Vervietois, of Verviers, whose tramway system at present terminates at Dison, has drawn up a scheme for an extension of the system to a number of places in the district, provided the municipal authorities of the little towns passed through, will accord the company the concession for the electric lighting of the district.

Croydon.—The B.C. on Monday had before it the problem of finding £20,252 in order to save an increase of the rates, which stand at 7s. 2d. in the £. It was decided to draw on the surpluses of the electricity and tramways undertakings—the former to the amount of £12,015 and the latter for £4,800. In addition, the Finance Committee appropriated £3,437 standing to the credit of the South Metropolitan tramway track account, a sum which it had been advised need no longer be reserved. Regarding the tramways contribution, this was the first of the kind towards the relief of the rates. The undertaking has been under the entire control of the Council since 1906, before which time it was leased to the B.E.T. Co. As a result of Monday night's raid on these departments, the Tramways Committee is left with only £3,200 of the surplus of £8,000 estimated for the year ending on 31st inst. The £12,015 above referred to means the wiping out of the surpluses of two years, but leaves the electricity undertaking with the full statutory reserve of £35,000. In making the appropriations the Finance Committee pointed out that it had not anticipated any of the surplus revenue that might accrue from these undertakings in 1911-1912.

Dover.—The vote on the question of running the tramways on Sundays was taken on Saturday last, and resulted in a majority of 1,164 in favour of Sunday running. The voting was: For a Sunday service, 3,074; against, 1,910.

Dundee.—Mr. Peter Fisher, the Corporation tramway manager, in a further report to the T.C. on the trackless trolley system, refers to the details of the Clepington Road scheme framed in 1908, which showed that the running expenses would amount to £438, and other expenses to £248, while the receipts would amount to £546, and there would thus be an apparent deficiency of £140. He regards that report as applicable to the situation at present, and states that Leeds and Bradford are at present equipping some miles of trackless trolley system, and 16 applications are being submitted to Parliament this session for power to equip and work routes with the trackless system of electric traction.

A lengthy report prepared by Mr. Fisher on the question of season and discount tickets for the cars was considered by the Tramway Committee at last week's meeting. The manager submitted the replies to questions addressed to managers of other undertakings as to their experiences of season and discount tickets, and showed that out of 71 undertakings reported upon, only 5 issue season tickets of any kind, and only in 3 of these cases are they issued to adults. Not one of the whole 71 has a word to say in favour of season tickets. With respect to discount tickets, it was learned that only 12 out of 70 municipal undertakings issue these, but of these only 8 issue them to the general public. Mr. Fisher counselled the Committee not to launch out on a scheme which is certain to shake the stability of the tramway undertaking.

Glasgow.—A special sub-Committee of the T.C.'s Tramway Committee appointed to consider as to municipal assessments levied on the tramways undertaking for the year 1910-11, has now reported that the Corporation had approved of proceeding with the appeal against the assessments for police, sanitary, Statute labour, sewage, roads and bridges, parks, &c., and a special legal representative has been appointed to represent the Tramways Committee in connection with the appeal.

The general manager has now submitted his report to the sub-Committee on tramways with regard to the two-stage fare experiment instituted some months ago on the whole of the T.C.'s undertaking, with the exception of the section in the burgh of Paisley, over which the Glasgow Corporation has running powers only, and which was not included in the experiment.

The T.C. is to be asked by the responsible Committee not to entertain the proposal to co-operate with the Paisley District Tramways Co. in issuing and working circular tickets to convey passengers over both the Corporation's and the company's lines. The proposal, it was contended, involved a reduction of fares.

Hastings.—At Friday's meeting of the T.C. a petition was presented by Mr. T. Ryan, of the Hastings Tramways Co., signed by 4,225 residents, asking that permission be given the company to install the overhead system on the Front line "in lieu of the unsatisfactory Dolter surface-contact system." The memorialists expressed the view that overhead wires would be more satisfactory and advantageous to the welfare of the town. The memorial was referred to the Railways and Tramways Committee for consideration.

Leith.—At a meeting of the Tramways Committee of the T.C. a motion regarding the extension of the tramway system from Seafield to Portobello was remitted to a sub-committee for consideration. The Edinburgh Corporation is to be communicated with in order to ascertain if it will fall in with the proposals so far as the Edinburgh portion of the road is concerned.

Liverpool.—In the tenth annual report of Mr. C. W. Mallins (general manager) respecting the Corporation tramways, it was stated that the number of passengers, mileage, and traffic receipts for the 12 months ending December, 1910, were:—Passengers, 125,507,283, an increase of nearly 4 millions as compared with 1909; miles run, 12,235,408, an increase of 283,035; and receipts, £582,276, an increase of £21,005. These figures constitute a record. The total revenue amounted to £614,814; operating costs, including rental of leased lines, £405,561; and gross profit, £209,252. This has been apportioned thus:—£50,342 interest; £60,643 to sinking fund and repayment of loans; £65,510 to reserve, renewal and depreciation account; and £32,755 contribution in aid of the general rate. The net profit amounted to £98,266, an increase of £15,911 over 1909.

London.—A stockholder in the Brighton Railway, writing to the *Norwood Press*, makes the statement that owing to the Supply Co., which is to provide electrical energy for the line, not having sufficient machinery available, the new electric service from the Crystal Palace to London Bridge *via* Tulse Hill will not be working before October next; it was generally understood that the line would be operated electrically within the next two months.

Malvern.—At a meeting of ratepayers on March 15th, resolutions were carried in favour of the railless trolley system, and calling upon the U.D.C. to cease its opposition to the preamble of the Electric Traction Bill now before Parliament.

Southend-on-Sea.—A L.G.B. inquiry was held on March 16th into the application of the T.C. for a loan of £1,261 for improving the tramway and station at the shore end of the Pier. There was no opposition.

The Light Railway Commissioners have granted an order authorising the extension of the tramways through the new Thorpe Hall Estate, and along the beach, to join up with the existing lines.

Sunderland.—At a meeting of the T.C. on the 15th inst. the borough and district rates were considered. Mr. G. H. Bain suggested, with a view of keeping the rates down, that the Tramways Committee should grant £2,000 out of the £3,680 set aside for reserve and renewals, and this was eventually agreed to.

Torquay.—On the recommendation of the Electric Light Committee, it has been decided by the T.C. to make a grant of £500 out of the funds of the undertaking towards the costs of the tramway arbitration.

Venezuela.—According to American advices, a proposal has been submitted to the Maracaibo City Council for constructing two electric tramways in the town and suburbs. At the present time, horse and steam cars are used.

Watford.—The U.D.C. has decided to oppose the application of Herts. C.C. for an extension of two years for carrying out the Light Railways (Watford and Bushey Extensions) Order, 1908. The Council has also decided to request the C.C. not to bring forward again any proposal for railless trolley cars for Watford, and that the Council's option to supply electricity should be restored in terms as advantageous to the U.D.C. as in the Order of 1908.

TELEGRAPH and TELEPHONE NOTES.

All-British Telegraphs.—At the conference of the Association of Chambers of Commerce of the United Kingdom, last week, a resolution was passed urging the provision of a State-owned Atlantic cable to complete the All-British connection between this country and Canada, Australia and New Zealand, and calling for a reduction in telegraphic rates to all parts of the Empire. A resolution was also adopted complaining of the delay in the transmission of telegrams to commercial centres on the Continent, and urging the adoption of improved methods.

Constantinople Telephones.—A fresh rumour is in circulation regarding the telephone concession which was granted last year to a French-English-American group in respect of the establishment and working of an exchange system in Constantinople. The rumour, to which publicity is given by the Vienna *Zeit*, is to the effect that the concession can be considered as definitely lapsed. On the other hand, the *Times* correspondent telegraphs that the concession has been definitely awarded to the international syndicate, and only awaits the sanction of the Turkish Parliament.

Glasgow.—Regarding the controversy between the Postmaster-General and the T.C. as to fire-alarm circuits being an infringement of the exclusive telegraph rights of the Postmaster-General, the P.M.G. has now written stating that he has no intention to interfere with the system of fire alarms maintained by the Corporation when duly licensed, and is willing to insert a provision in the licence to the Corporation that such licence shall not be determined except upon five years' notice. The Town Clerk has been instructed to complete the necessary licence accordingly.

Telephone Charges.—A Parliamentary return was issued last week, giving the telephone charges, the number of miles of telephone lines in operation, and the revenue and expenditure of each country in Europe. Owing to the varying conditions and methods of charging, comparison between them is difficult, but we may be able to deal with the return in a later issue.

Telephone Exchange "Hung Up."—A failure of the electric supply occurred at Preston on Friday last, and lasted for 11 minutes. The telephone exchange service was completely disorganised for a time. The exchange derives its power from the supply company, and no subscribers could be rung up from the exchange; in a brief space of time nearly 200 endeavoured to get through, the majority being subscribers clamouring to be put through to the electric light works.

The Telephone Transfer.—In the House of Commons Mr. H. Samuel recently stated that not only all the officers and servants of the National Telephone Co. in receipt of less than £700 per annum, who had been not less than two years continuously in the service of the company on December 31st next, would be taken into the service of the Post Office, subject to medical fitness, but also, in all probability, the great majority of the officers and servants of the company who had had less than two years' service on December 31st next, and who were in receipt of less than £700 a year, would be taken over, provided their health was satisfactory.

Telephone Wayleaves.—In reply to a question whether, when the undertaking of the Telephone Co. was taken over, any compensation would be paid to the railway and canal companies for the loss of wayleaves, &c., Mr. Herbert Samuel stated that the State purchased for large sums of money, at the time of the transfer of the telegraphs to the Post Office, full, and in many cases exclusive, wayleaves over the railways and canals. After the transfer of the undertaking of the National Telephone Co. to the Post Office, such of the telephone wires, legally telegraphs, as were acquired by the Postmaster-General, would be maintained under the wayleaves so purchased, and the Postmaster-General would make in respect of them all payments for which he was liable under the purchase agreements with the railway companies. No question of compensation arose in this connection.

In reply to another question, the Postmaster-General said that, speaking generally, any person on whose property poles or other fixtures had been erected by the National Telephone Co. would be entitled, after the transfer, to withdraw the facilities which he had granted in accordance with any agreement he might have previously made with the company. With regard to rentals in such cases, his position would be unaltered. As regarded poles on the roadside, the Postmaster-General had powers which were not enjoyed by the Telephone Co., and his position with reference to flying wires over property differed from that of the company. The Postmaster-General did not make any payments to local authorities in respect of such telegraphs, and would not do so in respect of those taken over from the National Telephone Co.

Wireless Telegraphy.—A new company has just been formed in Berlin, with a capital of £15,000, and the title Die Deutsche Betriebs Gesellschaft fur Drahtlose Telegraphie.

A wireless station is to be installed at Stanley, the capital of the Falkland Isles, which are otherwise without means of communication with the rest of the world, except by infrequent visits of shipping.

The Netherlands India Government intends to establish wireless telegraph stations at Sabang, Java, Timor Kupang and Amboyna.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—The Corporation Electricity Department will shortly consider offers for the erection of a sub-station at Culter.

Accrington.—Tramway storage battery, for the Corporation. See "Official Notices" March 3rd.

March 31st.—E.H.T. three-phase feeders, and low-pressure service and feeder cables, for the Corporation. See "Official Notices" to-day

Algeria.—April 10th. The Prefectural authorities at Oran are inviting tenders for the concession for the construction and working of an electric tramway, about 29 km. long, between Oran and El-Ancor.

Atherton.—March 27th. Materials, for the U.D.C. Electricity Department. See "Official Notices" March 17th.

Australia.—April 18th. One common-battery switchboard, for the P.M.G.'s Department in Western Australia. See "Official Notices" December 23rd.

May 8th.—Battery of accumulators, with boosters and switchboards, for the Melbourne City Council. See "Official Notices" February 24th.

June 14th.—Switchboard, common-battery, multiple, for the P.M.G.'s Department in South Australia. See "Official Notices" February 3rd.

June 14th.—Branching multiple magneto lamp-signalling switchboard, for the P.M.G.'s Department in Victoria. See "Official Notices" February 3rd.

April 19th.—Five motor-generators and one switchboard, for the P.M.G.'s Department in South Australia. See "Official Notices" March 10th.

April 25th.—175 miles of telephone cable, lead-covered, paper-insulated, and 717,000 paper sleeves, for the P.M.G.'s Department in Victoria. See "Official Notices" March 10th.

MELBOURNE.—April 19th. Deputy Postmaster-General. Telegraph and telephone material. Specifications, &c., High Commissioner, 72, Victoria Street, S.W.

March 29th.—Opalescent arc lamp globes, for the Melbourne City Council. See "Official Notices" March 17th.

July 25th.—Deputy-P.M.G., Melbourne. Twelve sections of a branching multiple magneto lamp signalling switchboard, &c., or one automatic or semi-automatic switchboard, for the P.M.G.'s Department in Victoria. See "Official Notices" to-day.

Bolton.—March 30th. Materials and stores for a year, for the Corporation Electricity Department. See "Official Notices" March 10th.

Belgium.—March 28th. The Société Nationale des Chemins de Fer, 14, Rue de la Science, Brussels, is inviting tenders for underground armoured cable, required for the light electric railways in the Brussels district.

April 4th.—The authorities of the Ecole de Pyrotechnie, Rempart de Hoboken, Antwerp, are inviting tenders for an electric lighting and power transmission plant at the School.

Bulgaria.—April 19th. The municipal authorities of Varna are inviting tenders for the concession for the electric lighting of the town.

Cavan.—April 10th. Generating plant and wiring at St. Patrick's College and the Bishop's House, for the Trustees. See "Official Notices" to-day.

Croydon.—March 27th. Electrical appliances for the B. of G.; the Union Offices, Mayday Road, Thornton Heath.

Edinburgh.—Mid-Lothian and Peebles District Asylum, Rosslynlee, invites offers for supply of electric fittings. Clerk, 19, Heriot Row, Edinburgh.

Glasgow.—April 24th. Steam turbo-alternator, with condensing plant, for the Corporation tramways. See "Official Notices" March 17th.

Govan.—March 28th. Stores for a year, for the Burgh Electricity Department. See "Official Notices" March 17th.

The Electricity Department invites tenders for the supply of stores for a year, including cables and accessories, bitumen and joint-box compound, house-service meters, fuse boxes, &c. T. C. Parsons, burgh electrical engineer.

Halifax.—March 28th. Electrical fittings, for six months, for the B. of G. Mr. A. T. Longbotham, Clerk, 4, Carlton Street.

April 4th.—Clothing, including caps and mackintoshes, for the Corporation tramway employés. Tramway offices, Skircoat Road, (returnable deposit of £5).

High Wycombe.—April 5th. Engines, pumps, compressors, turbines, ejectors, and other plant, at the sewage outfall works, for the T.C. Mr. T. J. Rushbrooke, borough surveyor, 77, Easton Street.

Kingston-upon-Hull.—March 28th. Two 2,000-KW. turbo-alternators, for the Hull Corporation. See "Official Notices" March 10th.

Leigh.—April 1st. One 500-KW. direct-coupled high-speed reciprocating generating set, evaporative condenser, extension to switchboard, and girder work for extension of crane, for the Corporation. See "Official Notices" March 17th.

Leeds.—March 31st. Twenty-five tramcar trucks and 10 electrical equipments, for the City Tramways Committee. See "Official Notices" March 17th.

Limerick.—March 31st. Materials and stores, for the Corporation Electricity Department. See "Official Notices" March 17th.

London.—L.C.C.—March 28th. Four electric watering-cars, with rail-grinding apparatus, and four complete electrical equipments for the same, to operate on both overhead trolley and conduit systems. See "Official Notices" March 10th.

HAMMERSMITH.—March 29th. High and low-tension switchgear and air-cooled static transformers, for the B.C. See "Official Notices" March 10th.

HACKNEY.—April 6th. Two water-tube boilers, one motor-turbine feed pump, and reconstruction of portion of the coal conveying plant, for the B.C. Electricity Department. See "Official Notices" March 10th.

ST. PANCRAS.—April 12th. (*a*) Arc lamp carbons; (*b*) motor-generator and balancer, for the B.C. See "Official Notices" to-day.

Manchester.—April 3rd. Signal, telegraph and electric fittings (form No. 32), and signal, telegraph, and electric light wires (form No. 33), for the Lancashire and Yorkshire Railway Co., for a year; Mr. Waring, Stores Dept., Osborne Street.

Newport.—April 8th. Lubricating oils for the Corporation Electricity and Tramways Departments. See "Official Notices" to-day.

Oldham.—The Tramways Committee has authorised the Tramways Manager to get out specifications for additional cars.

Roumania.—April 18th. The municipal authorities of Tecuci are inviting tenders for the concession for the public and private electric lighting of the town.

Rawtenstall.—March 31st. One 500-KW. three-phase steam alternator and one 250-KW. motor-generator, for the Corporation. See "Official Notices" March 17th.

Salford.—Electric light installation at the New Annexe, Town Hall. Borough Electrical Engineer. Deposit one guinea.

Stoke-on-Trent.—Electricity works plant, for the Borough Electricity Supply Committee. See "Official Notices" to-day.

Torquay.—April 13th. Turbo-generator, condensing plant and switchgear, motor-generator and switchgear, and electrically-driven feed pump, for the T.C. See "Official Notices" to-day.

Wallasey.—April 13th. Stores for the Corporation Electricity Department, for a year. Mr. J. A. Crowther, electrical engineer.

Wakefield.—March 27th. Three steam superheaters, for the Corporation Electricity Department. See "Official Notices" March 10th.

Warrington.—April 5th. Extra-high-tension cable and extension feeder panel, for the Electricity and Tramways Committee. See "Official Notices" March 17th.

April 5th.—Manganese steel curves for the Electrical and Tramways Committee. Specifications, &c., from Mr. F. V. L. Mathias, borough electrical and tramways engineer, Howley, Warrington.

Wigan.—March 27th. Supplies for the Corporation Electric Lighting and Tramways Departments. See "Official Notices" March 17th.

Worksop.—March 28th. Lathe, drilling machine and other accessories, for the U.D.C. Electricity Works. See "Official Notices" March 17th.

York.—April 11th. Reversible booster, switchboard and replating of storage battery, for the Corporation Electricity Department. See "Official Notices" to-day.

CLOSED.

Aberdeen.—The offer of Messrs. Willans & Robinson, Ltd., amounting to £4,726, for a new 1,000-KW. continuous-current turbo-generator has been accepted by the Corporation Electricity Committee. Ten offers were received, and that by the Rugby firm was the lowest. The generator will take the place of two small generating sets in the engine room.

Ashton-under-Lyne.—The tender of the Easton Lift Co., of London, has been accepted for a patients' lift at the District Infirmary, at £430.

Barnes.—The Sub-Committee appointed to consider the tenders sent in for the installation of generating plant reported as follows:—

Section 1.—Straight tube water-tube boiler and superheater, fitted for machine stoking. Six tenders for this section were received, varying in amount from £1,695 to £2,594, the lowest tender being that of Messrs. Babcock & Wilcox. The present boilers are of this firm's manufacture, and have given every satisfaction; they, therefore, recommend that the tender of Messrs. Babcock and Wilcox be accepted subject to the adjustment of details.

Section 2.—600-750-KW. steam dynamo. For this section nine tenders were received for turbine, and 43 tenders for reciprocating plant. The tenders for turbine plant varied in amount from £2,750 to £4,485, and for reciprocating plant from £2,411 to £4,892. After carefully considering the merits of the turbine-driven units, they concluded that the reciprocating plant was best suited to the Council's requirements. The lowest tenders for reciprocating plant were for machines direct-coupled to high-speed engines, by Messrs. Jas. Howden & Co., of Glasgow. The Committee considered the whole of the details submitted in connection with the plant, and concluded that, having regard to the small difference in price between the Howden and Belliss engines, to recommend the installation of a Belliss engine. The lowest tender submitted with this engine is that of the General Electric Co. (£2,627, plus £16). They therefore recommend that, subject to the adjustment of detail, this tender be accepted.

Section 3.—Surface condenser, motor-driven air and circulating pumps and piping. Thirteen tenders were submitted for this section, ranging from £1,370 to £2,420, the lowest being submitted by Messrs. W. H. Allen & Co.; they therefore recommend that this tender be accepted. The Council at their last meeting upon the foregoing report accepted the tenders as recommended of Messrs. Babcock & Wilcox; the General Electric Co., Ltd.; and Messrs. W. H. Allen & Co. The surveyor and electrical engineer are to carry out the river work.

Bradford.—The Sites, Buildings, &c., Sub-Committee of the Corporation recommends the acceptance of the tender of Messrs. C. Pratt & Sons, North Parade, for steel tubing and wiring for electric clocks, bells, &c., at the new Textile School for the sum of £184 10s.

Colchester.—The Electricity Committee has accepted the tender af Messrs. Venner & Co. for "P.P." meters, subject to the Council's approval, also for ordinary meters.

Croydon.—The B.C. has accepted the tender of Callender's Cable & Construction Co., Ltd., for supply of cables for the year ending March 31st, 1912.

Douglas (I. of M.).—The T.C. has accepted the tender of Messrs. G. C. Milnes, Voss & Co., Ltd., of Birkenhead, for a cable tramcar.

Dublin.—At a special meeting of the Corporation, held on Monday last in response to a requisition addressed to the Lord Mayor, who presided, to consider the report of the Electricity Supply Committee recommending for acceptance the tenders of Messrs. Babcock & Wilcox, Ltd., and the Maschinenfabrik Oerlikon for the extension of the plant of the generating station. Mr. Sherlock moved the adoption of the report, conditional on the L.G.B. granting the necessary loan. He said that the extension of the plant was necessary in order to keep pace with the ever increasing number of consumers. A very long discussion followed, and an amendment was moved to obtain an expert for information on the best means of obtaining electricity. The amendment was defeated by 4 votes to 34, and the motion was carried by the same poll.

Dungiven (Co. Derry).—The contract for the lighting of the town by electricity has been secured by Messrs. Francis Carr and Co., electrical engineers and contractors, of Belfast, in whose hands has been placed the complete installation, with the supplying of water turbine, dynamo, mains, &c.

Gloucester.—Messrs. Venner & Co. have received an order to supply tramcar meters here on trial.

Halifax.—The Public Library Committee has placed the order for the electric lighting installation at the Bankfield Museum with Mr. H. Moss.

Hereford.—The T.C. has accepted the tender of Messrs. Keith & Blackman for a "B" size rotary gas compressor with direct-coupled electric motor, at £36.

Keighley.—The Keighley and Bingley Joint Hospital Board has accepted the tender of Mr. H. Spencer, of Keighley, for electrical work.

Government Contracts.—During the past month the following contracts have beeen accepted by the Government departments named :—

ADMIRALTY.

Cells.—J. C. Fuller & Son; Siemens Bros. & Co., Ltd.
Switches.—Edison & Swan United E.L. Co., Ltd.

WAR OFFICE.

Motors.—Electric Construction Co., Ltd.
Lighting feeders (Curragh Camp).—Foote & Milne, Ltd.

INDIA OFFICE (STORE DEPARTMENT).

Apparatus.—Marconi's Wireless Telegraph Co.; Elliott Bros.
Engine.—British Westinghouse Electric Co.
Motors.—Thorneycroft & Co.

CROWN AGENTS FOR THE COLONIES.

Submarine cable.—Telegraph Construction and Maintenance Co., Ltd.
Electric light fittings.—J. Stone & Co., Ltd.

GENERAL POST OFFICE.

Telegraph apparatus.—Gell Telegraphic Appliances Syndicate.
Bell sets, telephone, &c.—British Insulated and Helsby Cables, Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.
Cable, I.R. and C.C.—British Insulated and Helsby Cables, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Cable paper core.—British Insulated and Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Johnson & Phillips, Ltd.; Siemens Bros. & Co., Ltd.
Joint box castings.—S. Thompson & Co. (Millfields), Ltd.
Creosoting poles, &c.—Burt, Boulton & Haywood, Ltd.; J. P. Corry & Co.; R. Wade, Sons & Co., Ltd.
Electric light fittings.—Wardle Engineering Co., Ltd.
Telephone indicators.—British Insulated and Helsby Cables, Ltd.
Spindle insulator.—Guest, Keen & Nettlefolds, Ltd.
Telephones.—British Insulated and Helsby Cables, Ltd.; British L.M. Ericsson Manufacturing Co.; Gent & Co.; Peel-Conner Telephone Works.
Electrically-driven centrifugal pumps, motors, &c., at G.P.O. (West), London, E.C.—Pulsometer Engineering Co. Ltd.
Local telephone exchange equipment.—Rutherglen, Glasgow; British Insulated and Helsby Cables, Ltd.
Laying of cast-iron pipes in Preston Telephone Exchange area, Brighton. —Greig & Matthews.

Llandudno.—For the U.D.C. Electricity Works a repeat order has been placed with Messrs. E. Bennis & Co., Ltd., for one of their high duty smokeless and gritless coking stokers and self-cleaning compressed-air furnaces for a water-tube boiler.

London.—HACKNEY.—The Electricity Committee has accepted the tender of Messrs. W. Cory & Sons, Ltd., for 10,000 tons of one or other of the following coals :—

Cowdenbeath and/or Edinburgh washed pea nuts, 11s. 6d.
Edinburgh small washed pea nuts, 10s. 9d.
Hillhouse washed pea nuts, 11s. 3d.

STEPNEY.—The Electricity Committee recommends the Council to purchase from Messrs. Bruce Peebles & Co., Ltd., a third converter, at £1,346.

BERMONDSEY.—The B.C. has accepted tenders for annual supplies as follows :—

W. Geipel & Co.—Arc lamp carbons.
Siemens Bros. Dynamo Works.—Arc lamp carbons and time-switches.
Sloan Electrical Co.—Flame lamp carbons.
Morgan Crucible Co.—Brushes.
Albion Clay Co., Ltd.—Conduits.
W. Lucy & Co.—Meter boards, street frames and covers, and joint boxes.
Sykes & Sugden, Ltd.—Joint boxes.
B.T.-H. Co., and Ferranti, Ltd.—Meters.
Reason Manufacturing Co.—Demand indicators.
General Electric Co.—Cut-outs, fuses.
Western Electric Co., W. T. Henley's Co., British Electrical and Manufacturing Co., W. H. Keys, and Craig, Sharp, Ltd.—Cable and jointing material.

POPLAR.—The B.C. has accepted the following tenders :—

Westminster Engineering Co.—Re-winding stator of converter, £140.
British Economical Lamp Co.—Providing and maintaining "Economical" 25-c.p. metallic-filament lamps to 170 points at the public libraries at 2s. 6d. per point during the year ended March 31st, 1912, subject to the option of the Council to extend the contract for maintenance for the following year at 2s. per point per annum.

L.C.C.—For the renewal of electric feeder cable for Blackwall Tunnel the tenders received were :—

W. T. Henley's Telegraph Works	(accepted)	£137
W. T. Glover & Co., Ltd.		147
Callender's Cable Co., Ltd.		156

The Asylums Committee has accepted tenders of the following firms :—

Electrical Sundries.—Pryke & Palmer, Siemens Bros. Dynamo Works, Ltd., Baxter & Caunter, Veritys, Ltd., General Electric Co., Ltd., Cox, Walkers, Ltd., Siemens Bros. & Co., Ltd.
Electric Lamps.—Edison & Swan Co., B.T.-H. Co., Siemens Bros. Dynamo Works, Baxter & Caunter, General Electric Co., Ltd.

BATTERSEA.—The B.C. Electricity Committee recommends the acceptance of the tender of the Sloan Electrical Co., Ltd., for the supply of arc lamp carbons, &c.

New Zealand.—Australasian Wireless, Ltd., was the successful tenderer for the erection of two high-power wireless telegraph stations and five smaller ones on behalf of the Government. The high-power stations will be erected at Doubtless Bay, on the north of the North Island, and at the Bluff, near Campbelltown, at the opposite end of the South Island. The smaller stations will be at Gisborne, New Plymouth, Christchurch and Wellington, and on the Government steamer *Tutanekai.—Australian Mining Standard.*

Norwich.—The T.C. has accepted the tender of Messrs. Gill & Son, of Norwich, for the erection of battery rooms at Duke's Palace Wharf, at £679.

Vancouver.—Amongst a number of Colonial contracts just secured by the D.P. Battery Co., Ltd., of Bakewell, is a 240-volt central-station set with auxiliary plant, for Vancouver.

Venezuela.—U.S. Consul Manning reports from La Guaira that Francisco J. Carreno has been given a contract by the municipality of La Victoria, State of Aragua, Venezuela, for the establishment of an electric light plant at that place, and that the preliminary work will be commenced in a short time.

Wakefield.—The T.C. has accepted the following tenders :—

Belliss & Morcom, Ltd.—600-kw. mixed-pressure turbine alternator £3,779.
British Electric Transformer Co., Ltd.—Two boosters, £92.
British Thomson-Houston Co., Ltd.—Six-panel switchboard, £558.

Watford.—The U.D.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for switchgear for the works sub-station, at £161.

Yeovil.—The T.C. has accepted the tender of Messrs. Harbour & Hobbs for telephonic communication between the municipal offices and police station and the Pen Mill sewage disposal works and isolation hospital, at £65.

FORTHCOMING EVENTS.

Physical Society.—Friday, March 24th. At 5 p.m. At the City and Guilds (Engineering) College. Papers on "A Sensitive Thermo Regulator," and "Experiments on the Measurement of Electrolytic Resistances using Alternating Currents," by Mr. H. F. Haworth; and "Oscillatory Currents in Coupled Circuits," and "Some Radio-Telegraphic Apparatus in use at the City and Guilds (Engineering) College," by Prof. G. W. O. Howe.

Electro-Harmonic Society.—Friday, March 24th. At 8 p.m. At the Holborn Restaurant. Last smoking concert of the season.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, March 24th. At 7.30 p.m. At Bolbec Hall, Newcastle. Resumption of discussion on Mr. A. F. White's paper on "Superheated Steam and Marine Engines"; paper on "Some Problems relating to the Use of the Internal-Combustion Engine for Marine Propulsion," by Mr. P. B. Newell.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, March 25th. At 5 p.m. At the Park Hotel, Cardiff. Abstract reading and discussion on the "Report on the use of Electricity in Mines"; and resumption of discussion on Mr. J. Simpson's paper on "Three-phase Motors for Haulage in Mines."

Association of Engineers-in-Charge.—Saturday, March 25th. Annual dinner.

Manchester Association of Engineers.—Saturday, March 25th. At 7 p.m. At the Grand Hotel, Manchester. Annual general meeting.

Borough Polytechnic Institute.—Saturday, March 25th. At 3 p.m. Annual exhibition of students' work.

Royal Society of Arts.—Monday, March 27th. At 8 p.m. Cantor lecture on "Applications of Electric Heating," by Prof. J. A. Fleming. (Lecture IV.)

Institution of Electrical Engineers (Newcastle Local Section).—Monday, March 27th. At 7.30 p.m. At the Armstrong College, Newcastle. Demonstration and short paper on "Wireless Telegraphic Working in Relation to Interferences and Perturbations," by Mr. J. E. Taylor.

Institution of Civil Engineers.—Tuesday, March 28th. At 8 p.m. Conclusion of discussion on Mr. P. Dawson's paper on "The Electrification of a Portion of the Suburban System of the L.B. and S.C. Railway."
Friday, March 31st.—At 8 p.m. Lecture on "The Uses of Chemistry in Engineering," by Mr. J. Swinburne.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, March 28th. At 7.30 p.m. At the University, Manchester. Annual general meeting. Lecture on "The Properties of the X-Rays from Radio-Active Matter," by Prof. E. Rutherford.

Belfast Association of Engineers.—Thursday, March 30th. At 7.45 p.m. At the Museum, College Square North. Paper on "Methods of Testing Centrifugal Pumps," by Prof. F. H. Hummell.

Royal Institution.—Saturday, April 1st. At 3 p.m. Lecture on "Radiant Energy and Matter," by Prof. Sir J. J. Thomson. (Lecture V.)

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

THE following orders are issued :—

Commanding Officer—LIEUT.-COL. H. M. LEAF.

Monday, March 27th.—"A" Company. Infantry drill, 7 to 7.30 p.m.; technical drill, 7.30 to 10 p.m.
Tuesday, March 28th.—"B" Company. Technical drill, 7 to 10 p.m.
Thursday, March 30th.—"C" Company. Technical drill, 7 to 10 p.m.
Friday, March 31st.—"D" Company. Recruits' infantry drill, 6.30 to 7.15 p.m.; technical drill, 7.15 to 10 p.m.
Saturday, April 1st.—Easter Camp. N.C.O.'s and men desirous of attending should notify Headquarters at once.

(Signed) P. H. CAMPBELL, Capt. R.E., Adjutant.

Monel Metal.—The Bayonne Casting Co. (Inc.) of Bayonne, N.J., U.S.A., has introduced an alloy of nickel, copper and other metals, made directly from the ore, under the name of Monel metal, which is said to have a tensile strength of 70,000 lb. per sq. inch when cast, and 80,000 to 100,000 lb. when rolled, and to be superior to copper and bronze in its resistance to corrosion, while it can be machined and forged, soldered or welded. It resembles pure nickel in appearance, and is recommended for mechanical parts that are in contact with salt water or superheated steam. A pamphlet recently issued gives full particulars of its qualities. Its electrical conductivity is 4 per cent. of that of copper, and its temperature resistance coefficient is 0·0011° F.

NOTES.

A Personal Matter.—We had a call on Tuesday last from a man of the name of Gemmell, who represented himself as being a technical journalist who had edited a certain paper—not electrical—until 12 months ago, when stricken down by Bright's disease, he lost his berth. We have had so many callers of this stamp recently who have endeavoured to play upon our sympathies, first desiring work and finally referring to their monetary difficulties, that we have got into the way of discrediting such stories. After giving a patient and inquiring hearing, we informed Mr. Gemmell that we had no employment to give him, though to all appearances Bright's disease has not wrought that havoc upon him that it does upon most of its victims. We should not have referred to the matter at all here had it not come to our ears on the following day that Gemmell was thought by some to be an assistant editor of the ELECTRICAL REVIEW. We hope that if this 5-ft high clean-shaven gentleman waits upon any of our readers, advertisers, or other friends, that they will remember that he is in no way whatsoever connected with this journal, or with the firm of H. Alabaster, Gatehouse & Co., nor is he authorised to call anywhere as being introduced by us. He came to us saying that the editors of certain contemporaries had sent him, but we have ascertained that that part of his story is false, as no doubt much of the remainder of his story is also.

May we also, while obtruding a more or less personal matter into our pages, ask our readers generally to assist in the protection of their own and our interests by communicating with us before rendering assistance in any shape or form to any callers who may use the name of the ELECTRICAL REVIEW, its principals or editors, without having unmistakeable evidence that the introduction they bear is genuine.

Electrical Apparatus in Mines.—Charges against Managers.—At Hamilton Sheriff Court on Monday, 20th inst., Robt. McKay, resident manager of the Cornsilloch Colliery, Dalserf, belonging to Messrs. Arch. Russell, Ltd., and James Salmond, Hamilton, general manager to Messrs. Russell, were indicted before Sheriff Shennan on charges arising out of complaints by H.M. Inspectors with regard to the electrical apparatus in Millburn Pit, which forms a portion of Cornsilloch Colliery. The charge against Mr. McKay, which was first heard, was that he had on October 20th last, in the Drummond coal seam, (1) failed to cover efficiently the electrical haulage motor: (2) failed to have the frame of the motor efficiently earthed; (3) failed to have the terminal and starting switch properly covered; (4) failed to efficiently or suitably protect an electric lighting wire and joint: and (5) in the Virtuewell seam suspended electric cables on iron nails instead of by leather or other flexible material. Evidence was given as to the discovery of the alleged defects by John Masterton, H.M. Inspector of Mines, and in his examination Mr. Robt. Nelson, H.M. Inspector of Mines, London, stated that he knew of two fatal accidents having been caused underground by insulating a wire with waterproof taping, as he found on the occasion of his visit to the pit, and he said he had known fires to have been caused in mines by sparks from a commutator covered with wood.—The colliery engineer, John Young, said that the motor referred to in the charge against the accused had been previously used in working a coal-cutter, and had he been given notice of any defect by the Inspectors he would at once have remedied it. No witnesses were called for the defence, and the Sheriff intimated that he would give his decision on Wednesday, 29th inst. Subsequently the charge against Mr. Salmond was proceeded with, it being averred that on the date in question, he had failed to have a competent person on duty in the pit where electrical apparatus and machinery were in use. The case for the prosecution was similar to that submitted in the charge against McKay, and H.M. officials averred that there was incompetency on the part of the person in charge of the electrical apparatus. It was argued for the defence that the prosecution was against the wrong official, as the appointment of competent persons rested with the colliery manager, and not with the general manager. Mr. Salmond had the supervision of 20 collieries, employing 811 persons, all of whom came under the competent person clause, and it was absurd to say that Mr. Salmond could examine and test all these as to competency. There had never been any accident under the man in charge of the electrical machinery at the time of the officials' visit. The Sheriff also made avizandum in this case.

Appointments Vacant.—Chief assistant to the borough electrical engineer, Devonport (£150); shift engineer for the electricity works of the Public Works Department, Southern Nigeria (£250); station superintendent for the Handsworth U.D.C. Electricity Supply Department (£120, with house, &c.); lecturer on "Electrical Design," for the University of London, University College. See our advertisement pages in this issue.

Regulations for Technical Schools.—The Board of Education announces that the new regulations for grants to technical schools, which will be issued during the coming summer, will not come into force until 12 months later. The regulations for University Institutions, however, will come into operation for the year 1911-12. New regulations with regard to the Science and Art Examinations, and the scholarships given and aided by the Board, are under consideration.

Institution and Lecture Notes.—BIRMINGHAM AND DISTRICT ELECTRIC CLUB.—On March 11th Mr. G. B. Walker gave a lecture on "Improvements in Small Electric Lighting Plants," which have enormously increased in number since the metallic-filament lamp arrived. In describing a house-lighting plant which was entirely automatic in its working—self-starting, self-stopping and self-regulating—he explained that it was controlled by an automatic battery charge and discharge regulator adjusted to operate between about 50 and 53·5 volts at the discharge terminals. In the charging circuit there was a time-element reverse-current circuit-breaker and a solenoid type automatic motor starter. Dynamo and discharge voltmeters were provided, the latter containing the device, which, through relays, controlled the reversing pilot motor which actuated the automatic battery regulator. There was also a centre-zero ammeter to indicate the charge and discharge currents, or the difference between them. The automatic battery regulator was provided with pilot contact-makers to make and break the solenoid circuit of the starter, and also a separate set to break the relay circuits when the regulator had reached the limit of its travel in either direction. A tumbler switch and a push switch were provided to enable the plant to be started or stopped at any time by hand, irrespective of the condition of the battery.

In this country there were many central stations in small towns having only a very small day load. An opportunity might occur for supplying a large house or hotel situated some distance from the station. Under ordinary conditions a cable of considerable section would have to be laid, and, in any case, the terminal voltage would be irregular, owing to the greatly varying load affecting the drop in the mains. By using a battery and an automatic regulator, the mains could be reduced to about one-fourth the size otherwise necessary. The voltage regulation would be greatly improved, and the current to charge the battery could be taken at any time during the 24 hours, instead of during the ordinary peak load.

ROYAL INSTITUTION.—The following are among the subjects announced for Friday evening meetings after Easter:—

May 19th.—Prof. R. W. Wood, LL.D., "Recent Experiments with Invisible Light."

June (date not fixed).—Mr. G. Marconi, LL.D. "Radiotelegraphy."

The arrangements for other days include the following:—

Thursdays, April 27th, May 4th and 11th, at 3 o'clock.—Prof. R. W. Wood, on "The Optical Properties of Metallic Vapours."

Thursdays, June 1st and 8th, at 3 o'clock.—By Mr. T. Thorne Baker, F.C.S., (1) "Changes Effected by Light;" (2) "Practical Progress in Wireless Telegraphy."

Mr. C. J. E. Stonier, of the Dundee Corporation Electricity Department, gave a lecture on the application of electricity for domestic purposes last week.

At a meeting of the EDINBURGH ASSOCIATION OF SCIENCE AND ARTS, on March 13th, Mr. George A. Carse delivered a lecture on "Modern Electrical Theory of Matter."

The Association of Electrical Engineering Students of the L.C.C. School of Engineering, Poplar, paid a visit to the London County Council tramways sub-station at the Elephant and Castle, on February 18th, and a paper on "Sub-station Operation," with special reference to the Elephant and Castle sub-station, was read by Mr. F. Allsop (member) on February 25th.

THE CONCRETE INSTITUTE.—The offices of the Institute will be removed from 8, Waterloo Place, S.W., to Denison House, 296, Vauxhall Bridge Road, Westminster, S.W., on March 25th. A library and reading-room will be formed for the general use of the members. The new Telephone No. is "2112 Victoria." The rules were recently altered so as to enable a Students' Section to be established, and a course of educational lectures on the subject of "Reinforced Concrete" is being arranged for students and the public, commencing April 26th, at 5.45 p.m., and occupying approximately one hour each, the lecturer being Mr. R. W. Vawdrey, B.A. Admission will be free, by ticket obtainable on application to the Secretary.

INSTITUTION OF POST OFFICE ELECTRICAL ENGINEERS.—At a meeting of the Metropolitan Centre, on March 13th, Mr. H. R. Rivers-Moore read a paper on "Small Prime Movers."

On Friday last Mr. W. Brooks Sayers gave a lecture at Glasgow on "The Uses of Electricity and its Relation to Smoke Abatement."

On Monday evening last at Hull, Mr. J. Wilkinson, M.I.E.E., the tramways electrical engineer, delivered a lecture on "Electric Tramways and Railways," illustrated with lantern slides, before the Myton Ward Ratepayers' Association.

INSTITUTION OF CIVIL ENGINEERS.—The annual dinner of the Institution was held on Friday last at Merchant Taylors' Hall. Mr. Alexander Siemens, the President, occupied the chair, and in responding to the toast of "The Institution," said that it was proposed to convene a conference on engineering education during the summer. He hoped that they would have an opportunity at the Imperial Conference to represent to the Colonies the desirability of recognising the qualifications of their members and of according them uniform treatment throughout the Empire.—*The Times.*

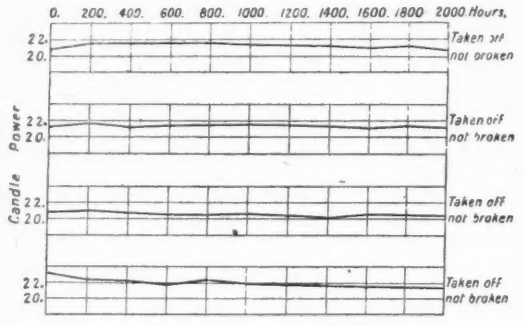
At the Inst.C.E. Students' meeting held on the 17th inst., Mr. Alwyne Meade read a paper on "The Production of Water Gas."

Last week, Mr. H. O. H. Wenman lectured before the Middlesbrough High School Engineering Society, on "Electric Furnace Methods of Iron and Steel Production."

On Friday last, Dr. Beckit Burnie, Principal of the Brighton Municipal Technical College, delivered a lecture on "Electrons."

Staff Dinner.—The third annual staff dinner of the South Metropolitan Electric Light and Power Co., Ltd., took place at the Trafalgar Hotel, East Greenwich, on Wednesday, 15th inst. The chair was taken by the engineer-in-chief (Mr. Henry W. Bowden), and after the dinner the evening was given up to a whist drive, songs, &c.

Ediswan Tungsten Lamps.—We recently referred to the tests conducted by the Westminster Electrical Testing Laboratory on metal-filament lamps of 15 different makes. We have just received particulars of the results of the tests on the four Royal Ediswan metal-filament lamps, which were run on 200 volts for 2,000 hours without a single failure. The curves given herewith show that the candle-power of the lamps remained practically constant


0. 200. 400. 600. 800. 1000. 1200. 1400. 1600. 1800. 2000 Hours.
Candle Power
22.
20.
Taken off not broken
Taken off not broken
Taken off not broken
Taken off not broken

Life Tests on Ediswan Lamps.

throughout the whole period, the curves being in this respect quite the most remarkable set that we have ever seen. We understand that, as might be expected, the watts, and therefore the watts per candle, also remained practically constant. Such admirable results are most gratifying, fully bearing out the high claims that have been made for the quality of these lamps, some of which have been known to burn for upwards of 5,000 hours.

Corona Losses on a 100,000-Volt System.—A paper was recently read before the American I.E.E. by Mr. Faccioli, describing tests made on the 100,000-volt system of the Central Colorado Power Co. at the generating station at Shoshone, on the primary side of the transformers. The corona and insulator losses were determined by subtracting the known value of transformer loss at each value of voltage from the measured total loss.

The following table gives an idea of the relative importance of the transformer losses and line losses as observed on the 153-mile line between Shoshone and Denver:

Kilovolts at Shoshone.	Transformer losses, KW.	Corona and insulator losses, KW.
80 ...	24 ...	109
90 ...	36 ...	341
95 ...	43 ...	598
100 ...	52 ...	1,003
105 ...	64 ...	1,623

It was found that the corona and insulator losses over the 63·5-mile section between Shoshone and Leadville were much less than proportional to the reduction in the length of line. Thus at 80 KV., 90 KV. and 100 KV. the losses were only 10·6 KW., 37·9 KW. and 152·0 KW. respectively. The author attributed the enormous increase in the loss throughout the longer line to the fact that the E.M.F. at the distant end was much higher than that at the station end, while the measurements were made at only the station end.—*Electrical World.*

Wireless Patent Case.—In the Chancery Division, Mr. Walter, K.C., applied to Mr. Justice Parker for leave to set down for hearing an application for the prolongation of Sir Oliver Lodge's patent. He asked, if convenient, that his Lordship would fix the hearing for Tuesday, April 4th, a day which would be convenient to the Attorney-General. There were, he said, no parties to the action except the applicant and the Attorney-General. His Lordship: Has this any connection with the Marconi patents? Mr. Walter said "No." He was now for Sir Oliver Lodge, and not Marconi. His Lordship fixed Tuesday, April 4th, subject to anything part heard.

Birmingham Electrical Contractors.—The annual dinner of the Birmingham Branch of the Electrical Contractors' Association was held on March 17th. Mr. H. Walker presided. Mr. Harland Bowden, the president, proposed "The Electrical Contractors' Association," and in the course of his speech said, respecting their differences with municipal electrical engineers, that they were determined—and they had the means—to protect the vested interests of the Association, and they would ultimately succeed.—Mr. Leonard Tate, general secretary, replied.—Mr. F. J. Moffett proposed "The Industry," and urged all sections to unite to further the interests of the industry as a whole, and not to be always trying to make a point by scoring off some other branch or interest that they thought was opposed to them.—Mr. H. Foulds, in responding, referred to the necessity of all engaged in the industry staying internecine warfare. There had always existed a friendly feeling between the Birmingham Electricity Supply Department and the contractors of the city. So long as the contractors of Birmingham showed the same enterprise as animated them at present, he did not think there would be any departure from that policy.—Mr. W. Brown proposed "The Central Station Engineers," and Mr. Barnard replied.

The Electrical Trades Benevolent Institution.—The annual report for 1910 is now in circulation, and it is to be submitted at the annual meeting on March 29th, at the Hotel Cecil. Every case for relief has been satisfactorily dealt with, either by way of pecuniary assistance or by obtaining appointments. The finances are shown in the balance-sheet, which we print below. A copy of the report has, for the first time, been sent to all donors and subscribers. It is pointed out that an important addition to the funds has accrued, due to the termination on March 20th of the Surplus Funds Trust of the Olympia 1905 Electrical Exhibition, but the invested funds of that Trust cannot be realised at the moment, owing to Sir W. H. Preece's absence in South Africa. The amount is in the neighbourhood of £380. The Institution has now been more than five years in existence, and so is within the range of calls being made upon its fund for pensions. The Committee, therefore, urge the necessity of considerably increasing the resources so as to be able to meet such claims without diminishing the capital or restricting its usefulness in the granting of temporary relief. It is suggested that the object of the Institution, as laid down in Rule 2, should be more clearly stated, and suggestions on this point are to be brought forward. This rule at present reads: "The object of the Institution is to grant pensions and to dispense temporary relief to deserving and necessitous persons who are, or have been, engaged in the electrical trade in the United Kingdom, or to their widows and families." There has been a good deal of questioning on this point at different times, and it will be as well to have it settled once and for all, and to let it be known far and wide just who and what are meant. Mr. W. Davenport's resignation of the secretaryship takes effect at the end of March, 1911, and Mr. F. B. O. Hawes has been appointed to the vacancy. The Committee expresses its thanks to the Institution of Electrical Engineers for placing at its disposal, free of charge, the use of Committee rooms for meetings.

Balance-Sheet, December 31st, 1910.

Receipts.		Expenditure.	
Jan. 1st, 1910, to balance in hand	£64	Dec. 31st, 1910, by grants made—	
Dec. 31st, ,, dividends on investment ..	76	F £10, G £7 2s., H £10 10s.	£27
,, subscriptions ..	49	By Printing, postage, petty cash, and cost of meetings	38
,, donations ..	279	,, secretary's salary, 1910 ..	25
		,, accountant's fee	1
		,, investment £200 New Zealand, 3½ per cent. stock	196
		,, balance of cash in hand and at bank	181
	£468		£468

Assets.

Previously invested, £1,000 Victoria 3½ per cent. cost	£1,101
£1,000 Cape of Good Hope 3½ per cent. cost	988
Invested in 1910, £200 New Zealand 3½ per cent. stock	196
Cash in hand and at bank	181
	£2,466

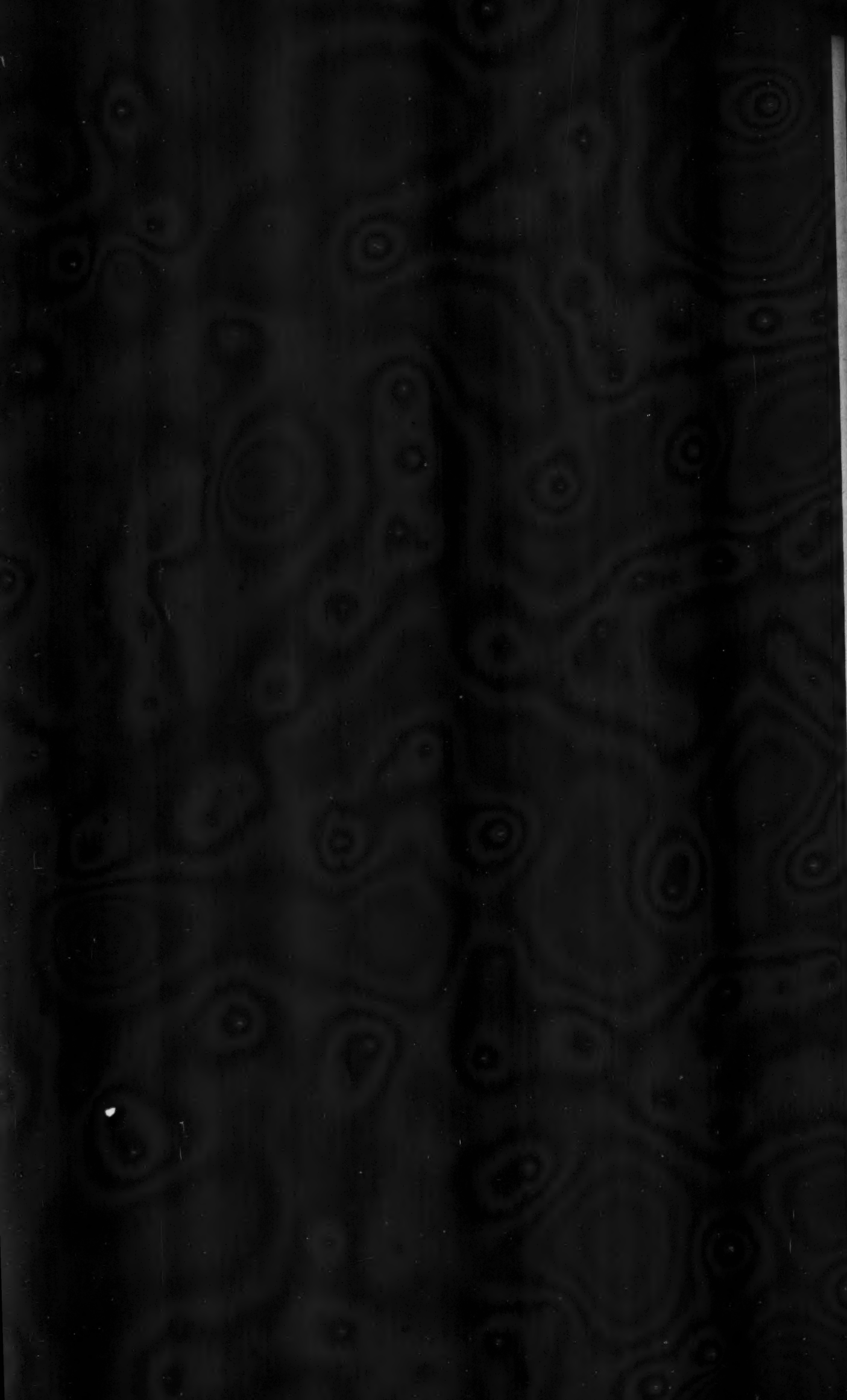
We have audited the above accounts with the books and vouchers of the Institution, and have verified the investments, and in our opinion they are correct.

HENLEY, SMITH & SON, *Auditors.*
March 6th, 1911. 34, Pauls Road, Tottenham.

Nottingham Engineering Society.—This society held its 14th annual dinner on Friday, March 17th, at the Victoria Station Hotel, some 200 members and guests being present. Mr. F. W. Davis, president of the society, occupied the chair, and accompanying him were Lord Henry Bentinck, M.P., Captain J. A. Morrison, M.P., Col. L. Rolleston, D.S.O., J.P., the Mayor, Sheriff and Councillors of Nottingham, and delegates from kindred societies in many parts of the country. There were some excellent speeches during the evening, and an admirable musical programme was provided. The toast of "The Chairman," coupled with that of "The Secretary" (Mr. F. A. W. Taylor), was received with great applause, and Mr. Davis, in replying, thanked the secretary for the great and untiring efforts that had made the society the great success it was.

On Saturday visits were made by the society and its guests to Howitt's factory, Nottingham Castle, the *Guardian* offices, and to places of amusement in the evening, lunch and tea being provided at the Victoria Hotel. On Sunday the party proceeded by motor-cars to the Bestwood and Popplewick Waterworks, lunching at the Hop Pole Hotel, Ollerton; the Boughton Waterworks were then visited, and motoring through the Lime Tree Avenue, Sherwood Forest, *via* the Normanton Inn, passing Clumber House, and proceeding *via* Carburton and Budley, to the Major Oak, Edwinstowe, Ollerton was again reached. Tea at the Hop Pole Hotel, and the run back to Nottingham, concluded a most enjoyable series of visits, the arrangements for which, made by the secretary, left nothing to be desired.

The Railless Trolley System.—On Friday last the "Cedes" Electric Traction, Ltd., gave a cinematograph exhibition of the working of some of the "Cedes-Stoll" railless cars on certain Continental routes. So far as it goes, a demonstration of this kind is the next best thing to seeing the cars in actual operation, and it fully demonstrated the facility with which the drivers of passing cars exchange their respective current collectors, steer along narrow roads and turn round at termini. The current collector in the "Cedes-Stoll" system is coupled to the car by means of a length of flexible cable, some yards of which are stored on a spring-controlled cable drum on the car, and are available in case the vehicle has to move far from the trolley wires. The car equipment consists of a tramway-pattern controller, and motors built into the rear wheels. Several Continental routes are operated on this system with eminently satisfactory results, and apart from small details in construction, the present year will probably see very similar cars in operation in this country.



PROGRESS AT WOLVERHAMPTON ELECTRICITY WORKS.

During the past two or three years the increasing demand for electricity for power purposes in Wolverhampton necessitated extensions of the plant at the electricity works, which Mr. Shawfield, the borough electrical engineer, has met by the installation of the most approved and up-to-date machinery.

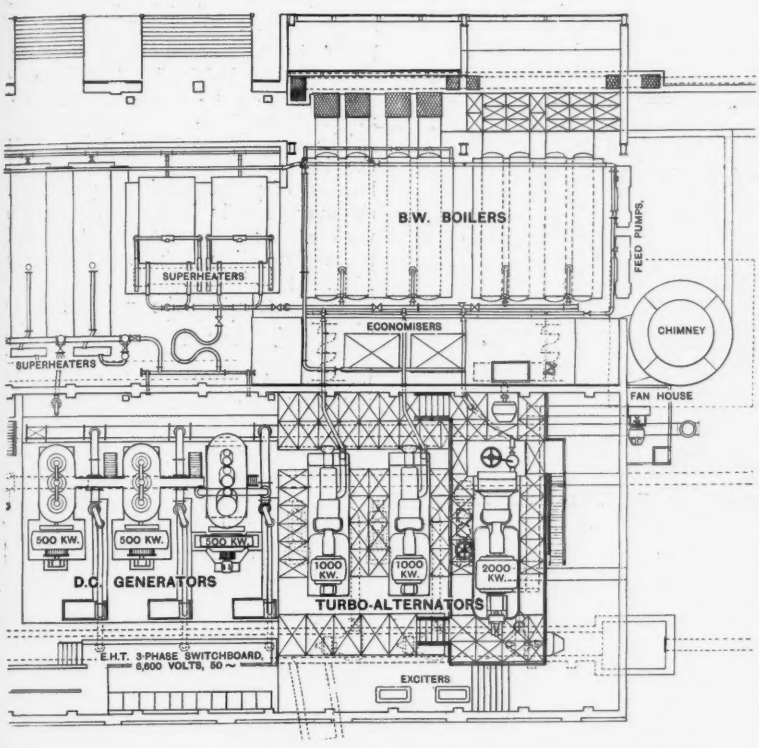


Fig. 1.—Showing the Arrangement of the Turbo-Generating Plant, Wolverhampton.

The erection of the original works was completed in January, 1895, when they were opened by the late Lord Kelvin: at present the electricity department has a main generating station, an auxiliary station at the refuse destructor, and three sub-stations.

The supply is on the direct-current three-wire system at a pressure of 440 volts between the outers, while 2,000 volts alternating current is also supplied.

Fig. 1 is a plan of a portion of the main station at Commercial Road. Towards the right are the new turbo-alternators, two of which, each of 1,000 K.V.A., three-phase, 6,600 volts, at 1,500 R.P.M., and 50 cycles, were brought into commission early in 1908. The third set, the most recent addition, is of 2,000-K.V.A. capacity, and fig. 2 shows this set being erected; all three sets are of Willans-E.C.C. manufacture.

The turbine is of the disk and drum high-pressure type, giving a continuous output of 2,000 K.V.A. at 1,500 R.P.M. with a boiler pressure of 150 lb. per sq. in. superheated to 465° F.

The alternator (figs. 3, 4, 5 and 8) is completely enclosed and pipe-ventilated, constructed with a solid steel rotor with embedded coils as shown in detail on page 478; the exciter is direct-coupled to the alternator and wound for a pressure of 70 volts.

The rated overload capacity is 50 per cent. for three hours, and the turbine is capable of giving its full load when exhausting to atmosphere.

During a full load run of 12 hours the temperature of the alternator does not exceed 65° F.

The condenser is also by Messrs. Willans, and is designed to maintain a 28½-in. vacuum, cooling water being provided at 66·5° F.; in connection with it is an Edwards-type air pump driven through single-reduction gearing from a direct-current motor, and a Rees Roturbo circulating pump capable of delivering 3,750 gallons per minute through the condenser.

The provision made by Mr. Shawfield for testing the steam consumption of his plant is perhaps better than that in any other electric generating station in England. Any one unit can be tested for steam consumption by the simple action of turning a valve, and at the same time, the continuity of record of the total steam of the station is not being impaired.

The plant is made up of two complete Lea recording instruments, each with its own V-notch tank, &c., but it is arranged in such a manner that the *test* recorder discharges into the *main* recorder, and thus all the condensed steam is measured at all times, even while a particular turbine test is in progress. The pipe lines from the various condensing plants are shown in fig. 6.

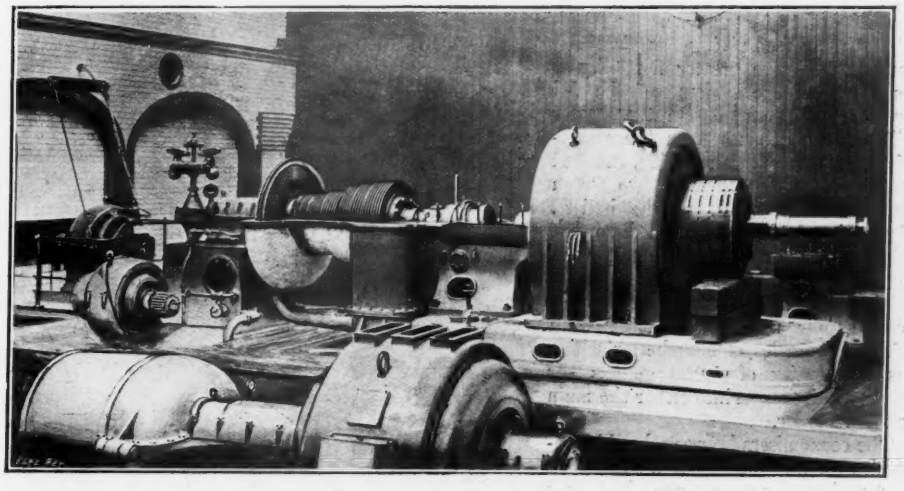


Fig. 2.—Willans-E.C.C. 2,000-K.V.A. Turbine Set under Erection.

The main recorder is of the combined indicating, recording and integrating type, and readings can be obtained of the rate of flow at any moment; the diagram provides an indication of the fluctuations in the load during the day as well as affording a means of computing the total load by means of a planimeter.

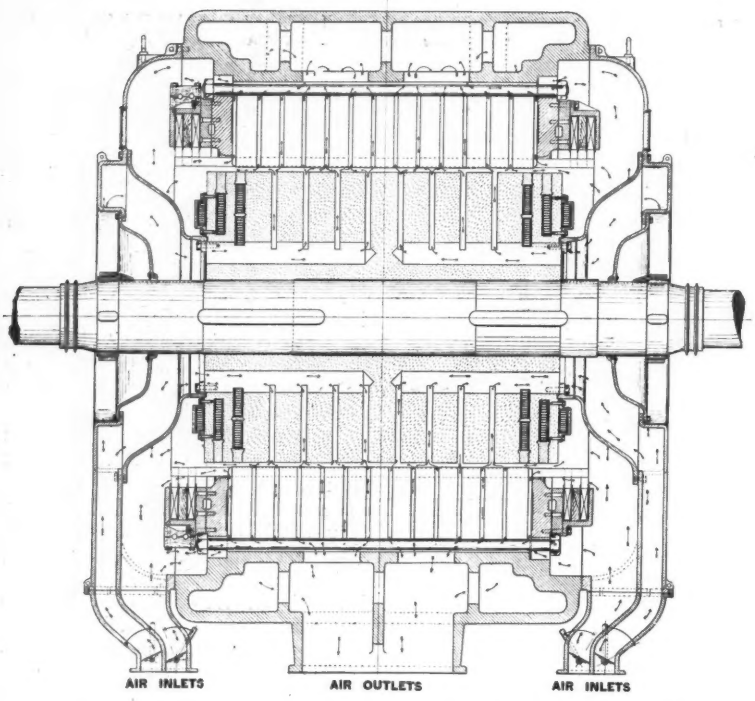


Fig. 3.—Arrangement of Ventilating Ducts, E.C.C. Alternator.

The integrating portion is used for reading off the total water at a glance, over any given period.

The test recorder is provided with three diagram clocks of different speeds, one performing one revolution per hour, another revolving once in four hours, and a third for 24 hours, the idea being that short tests on the turbines can be made to produce very large and sensitive diagrams by means of the quick running clocks.

This instrument is not provided with integrating mechanism, the total water being determined by the use of a planimeter.

A new pump house has been built containing all the boiler feed-pumps, and having above it a storage tank with a capacity of 16,500 gallons.

The boiler feed-piping has also been rearranged to give greater flexibility of working, and the boilers can be fed through a steam feed-water heater utilising the exhaust from the steam-driven pumps and fan engine, the feed afterwards passing through two Green economisers in series, to the boilers. Alternative feeds are provided, so that either economiser or the feed-heater can be cut out when required.

The make-up water taken from the town supply mains is treated in a softener by Royles, of Manchester, which has a capacity of 5,000 gallons per hour, and discharges into either the main or test recorder.

The economisers between the old Lancashire boilers and the brick stack have been replaced by a new one which is a duplicate of that between the new Babcock and Wilcox boilers and their steel stack.

The induced-draught plant in connection with these boilers has also been brought up to date.

A study of the output, price and cost per unit curve, fig. 6, shows that the sales of electrical energy for all purposes have increased tremendously during the past three years, occasioning much ingenuity and overloading in order to cope with the demand. The jump from 4,500 to 8,300 thousands of units constitutes quite a record.

Consumers of energy for power purposes are now practically all charged 1d. per unit or less, and are allowed to take up to 10 per cent. of their power consumption, in addition, for lighting, at power rates. Large consumers of 300,000 units per year are supplied at $\frac{3}{4}$d. per unit, the rate falling to $\frac{1}{2}$d. for increasing amounts.

The daily load curve, fig. 12, shows the increasing output with a general levelling of peaks. It is compiled from the average daily load taken over the week ending January 26th, 1910, and the corresponding week ending January 25th, 1911.

In 1904, when the problem arose of dealing with the destruction of the refuse of the borough, Wolverhampton made a decided step by installing an up-to-date combined refuse destructor and electric light and power sub-station, to serve the double purpose of dealing with the refuse, and supplying the needs of the electricity network round the site in Crown Street.

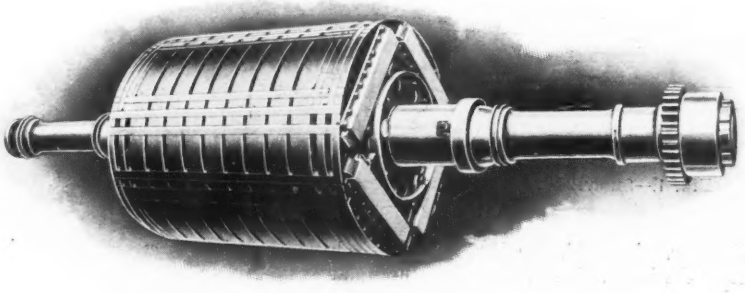


Fig. 4.—View of Rotor, E.C.C. 6,600-volt 3-phase Turbo-Alternator.

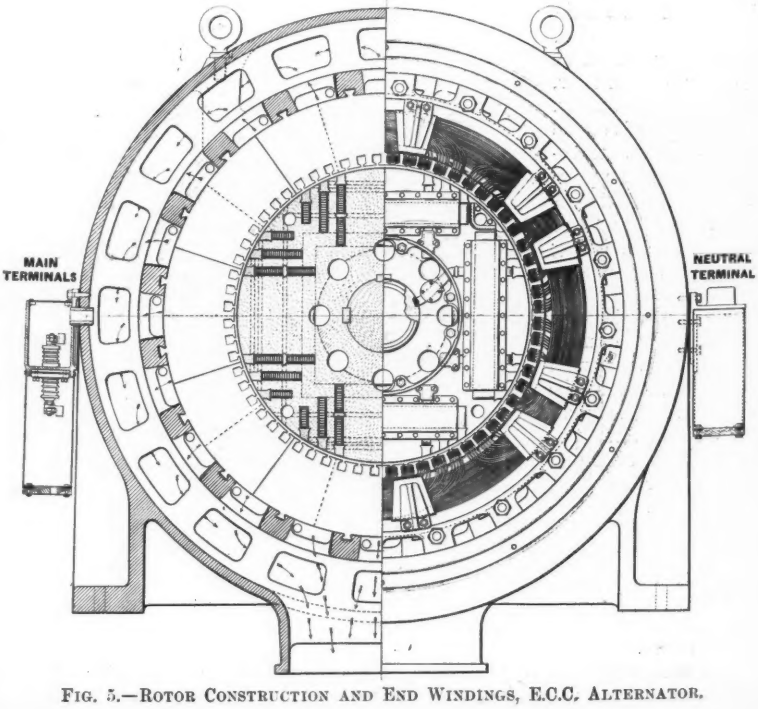


Fig. 5.—Rotor Construction and End Windings, E.C.C. Alternator.

Fig. 9 is a plan of a portion of the station installation, showing the electrical plant now being erected.

The destructor installation consisted of eight cells or furnaces, each nominally capable of consuming 10 tons per day, but actually burning a much larger quantity with forced draught.

With these are combined four single-drum Babcock and

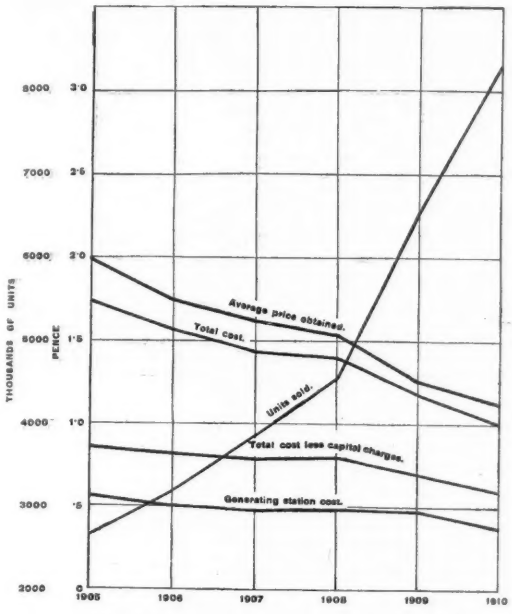


Fig. 6.—Cost and Output Curves, Wolverhampton Electricity Supply.

Wilcox boilers, each with 1,000 sq. ft. of heating surface, so arranged that each boiler is sandwiched between a pair of cells; to this there has just been added four more cells with two boilers sandwiched in the same manner, but of 2,000 sq. ft. heating surface.

This arrangement of cells and boilers has considerable

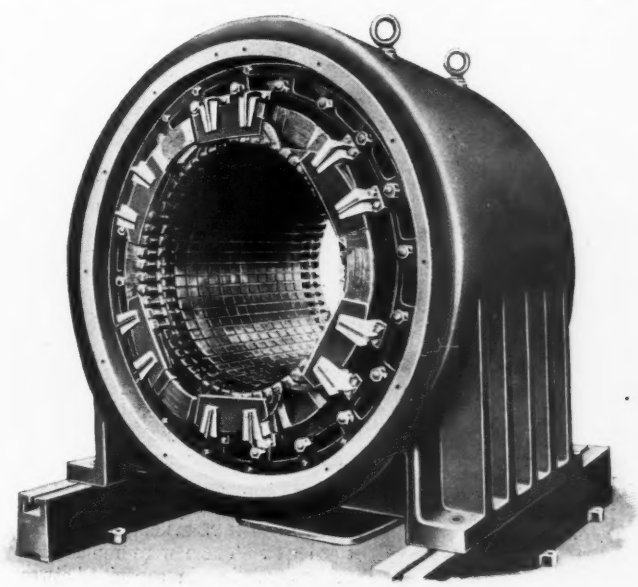


Fig. 8.—View of Stator, E.C.C. 6,600-volt 3-phase Turbo-Alternator.

advantages in maintaining steady heating of the boilers. Each boiler can be used as a steam generator entirely separate from the destructor when there is insufficient refuse.

Messrs. Manlove, Alliott & Co., Ltd., supplied the complete destructor plant.

The amount of refuse consumed daily varies considerably, but taken over the year the difference is not great, as may be noted from the following figures :—

	Tons of refuse.	Units generated.
Year ending March 31st, 1908	... 23,000	957,329
" " " " 1909	... 22,740	940,911
" " " " 1910	... 23,000	1,049,492

Having a constant supply of material, no difficulty has been found in maintaining a steady steam pressure of

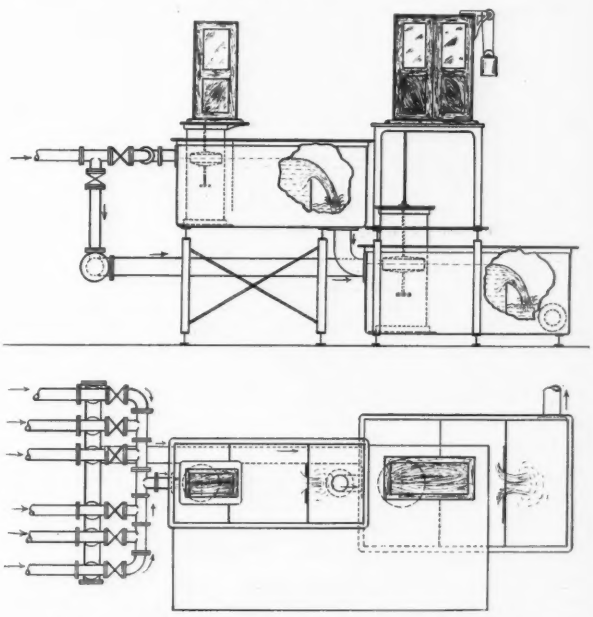


Fig. 7.—Showing Arrangement of Lea Recorders.

180 lb. per square inch. The Electricity Committee purchase the steam output of the destructor for running two 250-kw. d.c. generators, the engines of which have up to now exhausted to atmosphere. Under Mr. Shawfield's direction, a Willans mixed pressure turbine is now being installed to utilise this exhaust steam.

It is designed to give an output of 250 k.v.a. with exhaust steam only, 500 k.v.a. with a combination of live and exhaust steam, and 750 k.v.a. when running under live steam only as an overload. The pressure of the exhaust steam is 16 to 20 lb. per square inch absolute.

The turbine is fitted with high and low pressure stop valves, high-pressure steam separator, governor, emergency device for stopping when normal speed is exceeded by 10 per cent., &c. The governor is arranged so that live steam is automatically admitted when the exhaust steam supply is insufficient for the load.

In this case also, the alternator is of E.C.C. construction, designed to run in parallel with the turbo-alternators at the main power station, and to give 500 k.v.a. when running at 3,000 r.p.m.; it is of the totally-enclosed pipe-ventilated type, separately excited by a direct-coupled exciter, and it will give an overload up to 750 k.v.a. for two hours.

The Electric Construction Co. also built the e.h.t. switchboard, which is of the self-contained ironclad type, and stands directly on the floor over the cable trench (figs. 10 and 11).

The board is divided into six sections or cells of the well-known carriage type, the movable portion carrying all instruments, switches, and operating gear for the control of the circuit. Connection is made between the bus-bars and the movable part by means of sliding plugs.

The switchboard as at present arranged consists of two generator (one future machine) cells, three feeder cells, and one general cell for metering, synchronising, &c.; each of

the generator cells is equipped with an indicating wattmeter, oil-type circuit-breaker, ammeter, power-factor indicator and reverse-current relay: each feeder cell is equipped with ammeters, oil-type circuit-breaker and an overload relay.

The meter and synchronising cell carries the bus-bar integrating wattmeter, main voltmeters, a synchroscope and frequency indicator.

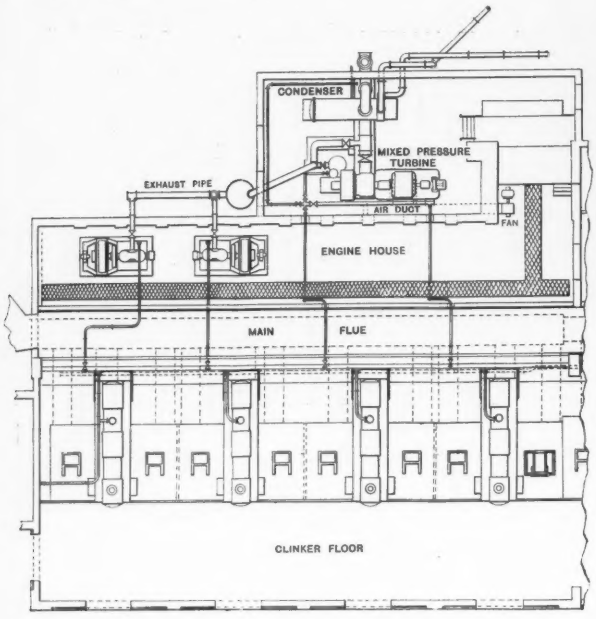


Fig. 9.—Plan showing Arrangement of Mixed Pressure Turbine, Wolverhampton Destructor.

In conclusion, we are indebted to Mr. Shawfield for his assistance in preparing these notes, as well as to Mr. Stubbs, who, under Mr. Shawfield's direction, designed and supervised the installations.

ELECTRIC DRIVING AT THE WORKS OF MESSRS. THOMAS SMITH & SONS, SALTLEY.

A trial of the electric motor on one or two machines recently resulted in the partial electrical equipment of the works of the well-known firm of Thomas Smith & Sons, of Saltley, Ltd. This firm is, perhaps, the largest of its kind in Great Britain making all classes of stampings and drop forgings for motors, agricultural implements, guns, ship builders and machine makers generally. Another branch of the firm's work, started over 62 years ago, is the manufacture of edged tools and hammers of sold steel, &c., for every known requirement. The plant displaced by the new method of driving consistsd of one 100-H.P., 40-R.P.M beam engine, a 30 ft. × 8 ft. 6 in. Lancashire boiler, one 8-H.P. and two 14-H.P. gas engines running on town gas. These were replaced by 11 motors, varying in capacity between $3\frac{1}{2}$ and 45 H.P., together with the necessary cables, switchboard, &c. Two gas engines and two steam engines are still in use.

The electrical supply is obtained from both the Bordesley and Saltley sub-stations of the Birmingham Corporation Electric Supply Department, and is fed into the works from two supply mains at 5,000 volts, three-phase, 25 periods, to

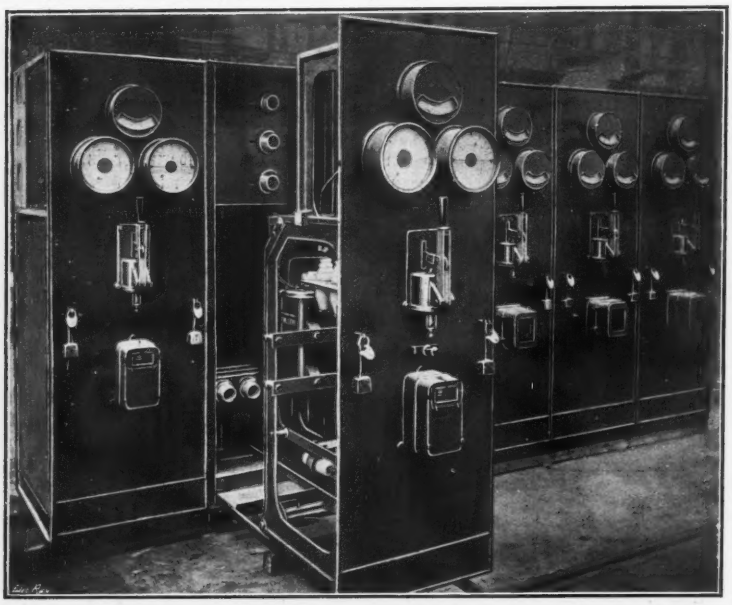


Fig. 10.—E.H.T. Switchboard, Wolverhampton, showing Cell Drawn Forward for Inspection.

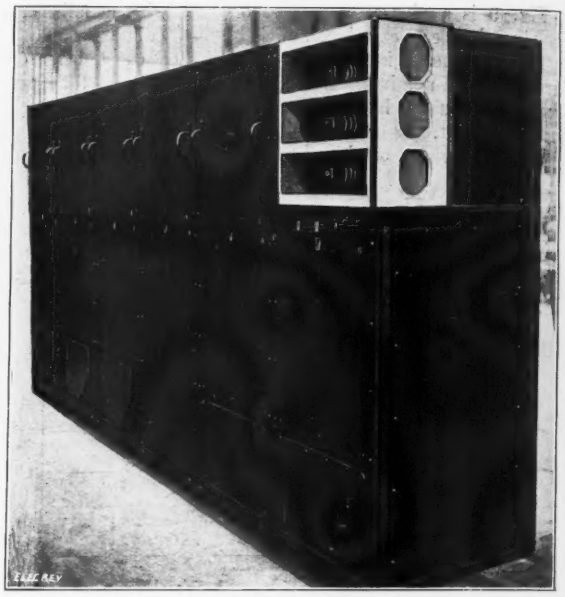


Fig. 11.—Rear of E.H.T. Switchboard, Wolverhampton, showing Access to Bus-bars.

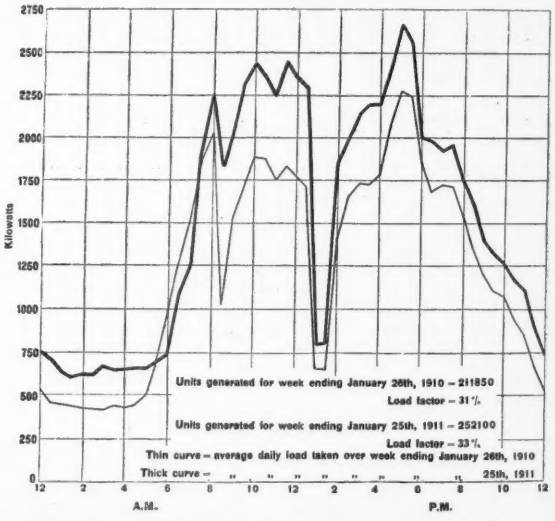


Fig. 12.—Comparative Load Curves, 1910 and 1911.

a H.T. three-panel ironclad switchboard in the sub-station. The switchboard is of the standard type used by the Birmingham Corporation Electric Supply Department, the outside panels being connected to the incoming feeders and the central one to the customers' circuits, arrangements being made for running off either supply. On each of the incoming feeder panels are two potential indicators and an oil switch. On the outgoing panel are fitted an ammeter, two potential indicators, a wattmeter, and an oil switch. From this panel the supply is taken to the main oil switch, mounted in a stone cubicle, from which it is led to a 200-K.V.A. 5,000/440-volt oil-cooled transformer; and then by armoured cables supported on porcelain insulators to a L.T. panel controlling the five outgoing circuits which are led to the distribution boxes in different parts of the works.

The steel used for the manufacture of the various tools is brought to the works in bars and cut to the lengths required before being heated in the furnaces, preparatory to being stamped out in the drop stamps to the particular shapes desired. A battery of 4 to 7 cwt. stamps is operated by a 45-H.P. motor. This motor is belted to line shafting running along the top of the stamps, on which are fitted the pulleys operating them. The furnace fires are blown by a 10-H.P. motor-driven fan. A second 45-H.P. motor drives a group of three stamps, the furnaces in connection with which are blown by a fan driven by a 7½-H.P. motor, and a 20-H.P. motor mounted on the framework of the stamps drives three sets through belting. A further 24-H.P. motor is utilised to drive two large American board stamps and two power presses, through belting.

From the stamps the forgings are taken to the emery wheels driven by a 7½-H.P. motor. The edged and other tools are taken to the grinding mills containing six large wet running stones driven by a 15-H.P. motor. The 7½-H.P. motor which drives the emery wheels, also drives the exhaust fan used to carry the dust from the wheels to the dust settling tanks. The motor is so mounted as to occupy no useful space.

The shop in which the polishing of the tools is carried out is operated by a 10-H.P. motor, fixed to the ceiling. This motor drives seven polishing machines, the exhaust fans used in connection with these being operated by a 4-H.P. motor. The handles for the different tools such as hammers, &c., are made on the premises in the wood-working department which is sectionised, and is driven by wo 5-H.P. motors.

The whole of the electrification of these works has been carried out by the British Westinghouse Co. to whom we are indebted for the above particulars.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Hackney Finance Committee recommends the adoption of the Electricity Committee's proposals that the salary of the works superintendent, MR. T. DALBY, be £200, rising by £10 annual increments to £250; that of the testing engineer, MR. E. MATTHEWS, £130, rising to £160; and that of the deputy generating engineer, MR. E. WILKINSON, £117, rising to £125.

On March 17th, at St. Pancras Electricity Department (Regent's Park Central Station), cases of silver-mounted pipes, seal tobacco-pouches, and engraved pocket-books were presented to MR. R. CRAY and MR. H. GRISWOOD, two of the staff, who have been with the Council a number of years, and who are sailing for Canada next week. Mr. J. T. Baron, M.I.E.E., resident engineer, made the presentation on behalf of the staff and employés, and wished the recipients every success in their new undertaking. Messrs. Cray and Griswood suitably responded.

MESSRS. E. W. L. NICOL and O. A. PILCHER, have resigned their positions as charge engineers at the L.C.C. Greenwich generating station, as from May 31st. Advertisements are to be issued inviting applications for the two vacated posts at £250 rising by £10 per annum to £300.

MR. P. G. CAMPLING, of the Weymouth electricity staff, has been appointed third engineer at the Bermondsey Corporation Electricity and Destructor Works.

Tramway Officials.—Blackpool Highways Committee on Monday increased the salary of MR. BANKS, assistant engineer-in-charge of the Promenade electric tramway works, from £3 10s. to £4 a week; and that of MR. FRED. G. WOLSTENHOLME, another assistant engineer engaged on tramway permanent-way work, from 55s. to 65s. a week.

General.—MR. J. GLYNN WILLIAMS, mining electrical engineer, late of the Moresby Coal Co., has joined the staff of the Electrical Trades Supply, Ltd., of Birmingham, in the capacity of mining representative.

The RIGHT HON. G. W. BALFOUR has been appointed a director of the St. James' and Pall Mall Electric Light Co., Ltd.

The Special Officials' Salaries Sub-committee of the Dewsbury T.C. has recommended that the salary of MR. R. H. CAMPION, electrical engineer, be increased from £350 to £375 per annum.

SIR HIRAM MAXIM will retire from his directorship of Messrs. Vickers, Sons & Maxim on his 71st birthday.

NEW COMPANIES REGISTERED.

Herd & Smith, Ltd. (114,469).—This company was registered on March 2nd, with a capital of £2,000 in £1 shares, to take over the businesses of manufacturing electricians, electrical engineers and contractors, carried on independently by W. M. Herd, of 9, Edmund Street, and by F. W. Smith, of 81A, Greig Street. Liverpool. The subscribers (with one share each) are:—W. M. Herd, 15, Highfield Grove, Rock Ferry, Cheshire, electrical engineer; F. W. Smith, 27, Roxburgh Avenue, Liverpool, electrical engineer; J. Greenwood, Cressington Park, Liverpool, bobbin manufacturer. Private company. The number of directors is not to be less than two or more than four; the first are W. M. Herd and F. W. Smith (managing directors); qualification, one share. Registered office, 9, Edmund Street, Liverpool.

Electrical Conduits, Ltd. (114,413).—This company was registered on February 27th, with a capital of £5,000 in £5 shares, to carry on the business of electrical conduit and fittings manufacturers, &c., and to adopt an agreement with B. W. Incledon and A. K. Incledon. The subscribers (with one share each) are:—W. B. Incledon, The Cottage, Darnt Green, Worcestershire, merchant; A. K. Incledon, 8, Montague Street, Edgbaston, Birmingham, merchant. Private company. The number of directors is not to be less than two or more than five; the first are W. B. Incledon and A. K. Incledon (both permanent, special qualification 100 shares); qualification of ordinary directors, 50 shares; remuneration (except managing director) as fixed by the company. Registered by C. Doubble, 14, Serjeant's Inn, E.C.

Efandem Co., Ltd. (114,506).—This company was registered on March 4th with a capital of £15,000 in £1 shares (10,000 preference), to take over the business of electrical and mechanical engineers and manufacturers, carried on by W. J. Fahn, W. Howcroft and P. McJunkin as the "Efandem Co.," at 244 and 246A, Corporation Street, and 155, Bracebridge Street, Birmingham, and at 83, Upper Thames Street, E.C. The subscribers (with one share each) are:—W. J. Fahn, 146, Portsdown Road, Maida Vale, W., consulting engineer; W. Howcroft, Southgate, 31, Orchard Road, Erdington, mechanical and electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are W. J. Fahn and W. Howcroft; remuneration as fixed by the company. Registered office, 71, Temple Row, Birmingham.

Pearsons (Electricians), Ltd. (114,511).—This company was registered on March 4th, with a capital of £2,000 in £1 shares, to take over the business of electrical, mechanical and sanitary engineers, decorators, plumbers and contractors carried on at 51A, Mosley Street, Manchester, as "H. Pearson & Co." and to adopt an agreement with Hannah Pearson. The subscribers (with one share each) are:—C. H. Pearson, 51, Park Street, Greenheys, Manchester, electrician; A. E. Jones, 58, Hartingdon Street, Moss Side, Manchester, cashier. Private company. The first directors are Hannah Pearson and C. H. Pearson (manager). Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

A. B. Carter & Co. (Belgium), Ltd. (114,500).—This company was registered on March 4th, with a capital of £2,000 in £1 shares, to carry on the business of electricians, engineers, suppliers of electricity for light, heat, motive power or other purposes, manufacturers of and dealers in electric, magnetic, galvanic and other apparatus, &c., and to adopt an agreement with J. Wenk. The subscribers (with one share each) are:—W. Powell, 28-29, St. Swithin's Lane, E.C., solicitor; J. Wenk, 107A, Strand, W.C., advertising contractor. Private company. The directors are to number not less two or more than five; J. Wenk is permanent chairman and managing director. Registered office, 107A, Strand, W.C.

Engineering Works (Electrical and General), Ltd. (114,598).—This company was registered on March 9th, with a capital of £3,000 in 2,925 shares of £1 each and 1,500 shares of 1s. each, to carry on the business indicated by the title. The subscribers (with one share each) are:—J. J. B. Cross, Broad Street House, E.C., engineer; D. Hickie, 14, Harp Lane, E.C., mining and machinery expert. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; remuneration one guinea each per meeting attended (chairman, half guinea extra). Registered office, 7-8, Great Winchester Street, E.C.

J.G.B. Syndicate, Ltd. (114,689).—This company was registered on March 14th, with a capital of £7,500 in 7,000 preference shares of £1 each and 10,000 ordinary shares of 1s. each, to carry on the business of electrical and mechanical engineers, &c. The subscribers (with one share each) are:—A. L. Gregory, 29, Buckingham Palace Mansions, S.W., engineer; W. T. Ditcham, Harvard Lodge, Broom Road, Teddington, electrician. Private company. The number of directors is not to be less than two or more than five; the first are not named. Registered by G. F. Hudson, Matthews & Co., 32, Queen Victoria Street, E.C.

"Phozone," Ltd. (114,763).—This company was registered on March 17th, with a capital of £5,000 in £1 shares, to acquire any invention relating to telephone and other instruments and the cleansing or disinfecting of the same, &c. The subscribers (with one share each) are:—G. G. Belcher, 90, Queen Street, E.C., general merchant; J. W. Trail, 38, Denbigh Street, S.W., retired Army officer; C. M. Houghton, 83, Strathyre Avenue, Norbury, merchant. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; remuneration, £25 each per annum. Registered office, 10, Camomile Street, E.C.

Perry & Grinsell, Ltd. (114,657).—This company was registered on March 11th, with a capital of £2,000 in £1 shares, to carry on the business of manufacturers of electrical heating and ventilating devices and machinery accessories, casters, die sinkers, &c., and to adopt an agreement between W. P. Perry and L. B. Thomas. The subscribers (with one share each) are:—W. P. Perry, Glenavon, Woodfield Avenue, Penn, near Wolverhampton, electrical engineer; G. H. Grinsell, Caerloon, Alderbrook Road, Solihull, accountant. Private company. The number of directors is not to be less than two or more than five; the first are L. Grinsell and W. P. Perry (permanent managing director); qualification, £100; remuneration as fixed by the company. Registered office, 1 and 2, Leopold Street, Birmingham.

General Electric Co. of China, Ltd. (114,707).—This company was registered on March 15th, with a capital of £21,000 in 20,000 preference shares of £1 each and 20,000 ordinary shares of 1s. each, to secure the sole representation and agency in the Empire of China and Hong Kong of the General Electric Co., Ltd., of 67, Queen Victoria Street, E.C. The subscribers (with 100 preference shares each) are:—E. S. Byng, 67, Queen Victoria Street, E.C., electrical engineer; L. G. Byng, 67, Queen Victoria Street, E.C., electrical engineer. Private company. The number of directors is not to be less than three or more than seven; the first are H. Hirst, E. G. Byng, L. G. Byng and P. H. Nye: qualification, 100 shares; remuneration as fixed by the company. Registered office, 67, Queen Victoria Street, E.C.

Terek-Goktcha Syndicate, Ltd. (114,744).—This company was registered on March 16th, with a capital of £2,500 in 1s. shares (10,000 "A"), to acquire any concessions, grants, decrees, rights, powers and privileges for the construction or operation in any part of the world of electric or hydraulic powers, works, plants or installations, &c. The subscribers (with one share each) are:—A. Hill, 4, Broad Street Place, E.C., mining engineer; T. W. Carr, 4, Broad Street Place, E.C., ch. secretary; Mrs. M. Hill, Merry Lee, Northwood; Mrs. I. I. Stewart, Wahroonga, Hatch End; L. Rowell, 4, Broad Street Place, E.C., secretary. Private company. The number of directors is not to be more than five; the first are A. Hill, C. H. Stewart and T. W. Carr; remuneration as fixed by the company. Registered office, 4, Broad Street Place, E.C.

Vitty & Hopper, Ltd. (114,747).—This company was registered on March 16th, with a capital of £1,500 in £1 shares, to carry on the business of electrical, hydraulic and mechanical engineers, house decorators and furnishers, builders, dealers in mechanical or electrical novelties, &c. The subscribers (with 100 shares each) are:—T. A. Vitty, Eversleigh, Tankerton, Whitstable, electrical engineer; E. T. Hopper, Wayside, Bungalow Way, electrician; H. C. Scott, 81, Crescent Road, Ramsgate. Private company. The number of directors is not to be less than two or more than five; the first are T. A. Vitty, E. T. Hopper and H. C. Scott; qualification, 100 shares. Registered by R. C. Charlton, 48, Oxford Street, Whitstable.

T. W. Vaughan & Co., Ltd. (114,718).—This company was registered on March 15th, with a capital of £5,000 in £1 shares (3,000 6 per cent. cumulative preference), to take over the business of electric lighting, heating, ventilating and general engineers and art metal workers carried on by T. W. Vaughan and W. G. Smail as T. W. Vaughan & Co. The subscribers (with one share each) are:—T. W. Vaughan, 22, Cross Street, Islington, N., engineer; M. Kidner, 18, Minster Road, West Hampstead, gentleman. Private company. The number of directors is not to be less than two or more than four; the first are T. W. Vaughan and M. Kidner (both permanent); qualification, 750 shares; remuneration as fixed by the company. Registered office; 22, Cross Street, Islington.

C. Fenton Lindop, Ltd. (114,772).—This company was registered on March 18th, with a capital of £2,000 in £1 shares, to carry on the business of electrical, mechanical and general engineers, manufacturers of and dealers in electric lamps, electric motors, switches, cut-outs and other electrical apparatus, &c., and to adopt an agreement with C. F. Lindop. The subscribers (with one share each) are:—R. Lindop, 16, Moss Lane, Liverpool, accountant; E. R. C. Lindop, 16, Moss Lane, Liverpool, electrical engineer; A. R. Jones, 15, Oakhill Road, Liverpool, manager; R. Thompson, 13, Wasdale Road, Aintree, merchant tailor. Private company. The number of directors is not to be less than two or more than four; the first are not named; qualification £100. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Express Cable Inventions, Ltd. (109,071).—Particulars of £6,000 debentures created February 3rd, 1911, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Singapore Electric Tramways, Ltd. (84,088).—A memorandum of satisfaction to the further extent of £14,400, between May 9th, 1910, and February 15th, 1911, of debentures dated November 30th, 1906, securing £350,000, has been filed.

Carmarthen Electric Supply Co., Ltd. (105,409).—Particulars of £3,000 debentures, created February 22nd, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £2,300. Property charged: the company's property, present and future, including uncalled capital. No trustees.

Chagford and Devon Electric Light Co., Ltd. (32,777).—Particulars of £1,000 first and £2,000 second debentures, created by resolutions of January 16th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amounts being now issued. Property charged: The company's undertaking and property, present and future. No trustees.

Durham Collieries Electric Power Co., Ltd. (83,421).—Issues on March 1st, 1907, of £150,000, on May 10th, 1910, of £8,000, on July 11th, of £3,800, and on October 26th, of £5,500 debentures, all parts of series of which particulars have already been filed. (All above issues registered on February 28th, 1911.)

Rangoon Electric Tramway and Supply Co., Ltd. (86,932).—A memorandum of satisfaction to the extent of £11,719 of debenture stock dated February 1st, 1906, and December 22nd, 1908, securing £250,000, has been filed.

Ernest Scott & Mountain, Ltd. (32,760).—Particulars of £35,000 second debentures, created by resolutions of December 18th, 1906, and January 13th, 1911, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £10,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Gilbert Arc Lamp Co., Ltd. (52,679).—Particulars of £5,000 debentures, created February 1st, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £3,500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Imperial Light, Ltd. (86,560).—Issue on February 22nd of £1,000 debentures, part of a series of which particulars have already been filed.

Sunbeam Lamp Co., Ltd. (25,488).—Issue on February 27th of £1,000 debentures, part of a series of which particulars have already been filed.

Delhi Electric Tramways and Lighting Co., Ltd. (88,758).—Issues on various dates from September 5th, 1910, to January 7th, 1911, of £2,600 debentures, part of a series of which particulars have already been filed.

Johnson Secret Wireless Telegraph and Telephone Testing Syndicate, Ltd. (85,182).—Debenture dated February 20th, 1911, to secure £50 or £100, as the case may be (as in the debenture provided), charged on all new machinery, plant, &c., to be purchased by the company out of a sum of £100 to be advanced by F. G. Lloyd and others by moieties of £50 each, as required.

Lodge-Muirhead Wireless and General Telegraphy Syndicate, Ltd. (70,681).—Return dated January 4th, filed January 16th, 1911. Capital, £50,000 in £1 shares (29,000 preference). 23,007 ordinary and 13,151 preference shares taken up. £1 per share called up on 3,158. £3,158 paid. £33,000 considered as paid on 33,000. Mortgages and charges: £7,600.

I.T.E. Electric Co. (1907), Ltd. (95,222).—Return dated February 6th, filed February 10th, 1911. Capital, £1,000 in £1 shares. 107 shares taken up. £107 paid. Mortgages and charges: £2,400.

London Electric Warehouse Co., Ltd. (67,568).—Return dated January 13th, filed January 14th, 1911. Capital, £1,000 in £10 shares; 8 shares taken up; £10 paid; leaving £70 in arrears. Mortgages and charges: Nil.

CITY NOTES.

South London Electric Supply Corporation, Ltd.

The annual meeting was held on Tuesday at the Cannon Street Hotel, E.C., Mr. J. Atherton presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 438), said the number of lamps connected to the circuits last year was equivalent to 21,785 35-watt lamps. The total number of lamp connections at the end of the year was equivalent to 232,179, since increased to over 237,000. The total units sold amounted to 4,101,539, as compared with 3,705,208 for the previous year, an increase of 396,331 units, or 10·7 per cent., producing an increased revenue of £2,833. Despite the almost universal use of metallic-filament lamps, which consumed so much less current than the old carbon lamps, from the figures which they had before them of the output since the beginning of the year, they believed that their lighting revenue would continue to steadily increase, as, electricity being now as cheap as gas, the public were taking up the illuminant in ever-increasing numbers for private houses and shop lighting. The profit on the year's working had been increased by £2,639, and as the increased revenue for the year only amounted to £2,083, it followed that not only had that additional revenue been wholly retained as profit, but £556 in addition. The total expenditure on revenue last year was £17,689, against £18,245, a reduction of £556, notwithstanding the fact that in 1910 they sold nearly 400,000 more units than in 1909. That satisfactory result was due to more economical cost of production which had mainly been brought about by the installation of modern turbine plant. The total cost per unit sold last year was only 1·04d. against 1·18d.; a decrease of nearly 12 per cent. Although the company's generating station was, from the point of view of cheap production, not so well placed as some of the other generating stations in the metropolis, their charge costs compared most favourably with the best results obtained in London. The amount spent in coal last year was £6,623 as against £7,261 in the previous year, although the cost of coal per ton was practically the same in the two years. They had been successful in placing contracts for their coal supplies over the whole of the present year at prices which they regarded as satisfactory. They were slightly in excess of the prices paid last year, but they did not anticipate that they would have any material effect upon the cost of production for the year. At the end of 1910 they had 3,540 H.P. of motors connected to the mains, being an increase of 450 H.P. during the year; and no less than 1,819,958 units, or nearly 45 per cent. of units sold were consumed by those motors. Since the beginning of the present year they had been successful in completing further important contracts for power supply amounting to over 250 H.P., and in addition many new applications had been received for lighting supply, so that there was every reason to hope that this year's output would continue to increase. The capital expenditure during the year was £14,872, the greater part of which had been expended on the installation of the 1,500-KW. steam turbine alternator, complete with its auxiliaries. This plant was put into service in March last year, and had since run very successfully, and had fully met their expectations in all respects. The remaining items on capital expenditure were principally for mains, transformers and meters, installed to meet the increasing demand for lighting and power supply. The plant in their generating station was sufficient to cope with the present load, and with any additional demand which might be made during the present year, but if the present rate of progress was maintained in the next year, they would probably have to consider at the end of the year the question of further additions to the plant, so that they might be available for use during 1912. The percentage of profit on the total capital raised had risen from 5·75 to 6·52 per cent. The gross profit for the year amounted to £23,469, and after providing for debenture and other interest, they had set aside £5,000 for depreciation. That was in excess of the sum put aside last year, and was due to the fact that they had placed a contract for the replacement of the whole of their high-tension switchgear in the generating station, and that they also intended to rebuild one of their cooling towers during the present year. The cost of both those works would be chargeable to the depreciation fund, and therefore they had carried £2,000 more to that fund than usual. The balance of profit amounted to £14,002, out of which they recommended a dividend at the rate of 5 per cent. per annum on the ordinary shares.

Mr. Kettell, a shareholder, seconded the motion.

Reply to questions, the Chairman said the company had been doing all they could to secure the contract for electric supply to the new King's College Hospital, and the matter was not yet settled. With regard to their provision for depreciation, the board considered it ample, seeing that the station and plant were kept thoroughly up to date out of revenue. The writing down of the shares from £5 to £4, which was done some years ago, had enabled the board to pay a dividend, but it would in no way affect the price they would obtain for the company when it became purchasable by the local authority.

The report was adopted.

County of Durham Electrical Power Distribution Co., Ltd.

The report of the directors for the year ended December 31st, 1910, states that the total connections to the company's system at the end of the year (including the connections of its associated Parliamentary company, the County of Durham Electric Power Supply Co.) amounted to 39,070 H.P., which shows an increase of 4,046 H.P. The profits of the year, together with the balance of £262 brought forward from 1909, amount to £28,968, against which has been charged interest on loans and debenture stock £13,435, leaving an available balance of £15,533, out of which the directors recommend a dividend of 3¾ per cent. on the preference shares (of this an interim dividend of 2½ per cent. was paid in October last amounting to £6,250) = £9,375, the transfer to depreciation and reserve account of £6,000, carrying forward £158. For a considerable portion of the year the consumption of electrical energy throughout the area—and, consequently, the revenue of the company—was adversely affected by the unsettled state of the coal trade and labour market. The expenditure on capital works during the year has been £21,080, of which £15,386 represents the outlay on the company's account, and £5,693 the outlay on behalf of this company's associated company, the County of Durham Electric Power Supply Co., for which this company receives shares therein. The difference between the above figure of £15,386 and the credit of £26,698 shown in the capital account is accounted for by the fact that certain capital expenditure in connection with trunk mains and sub-stations, incurred since the end of the year 1906, and which, pending consideration of the proper method of dealing with such expenditure, has been dealt with through this company's accounts, has now, in accordance with the advice of the auditors and solicitors, been transferred to the accounts of the County of Durham Electric Power Supply Co., in respect of which transfer this company receives shares. This transfer in no way affects the revenue account. The directors record the death of the Right Hon. Robert Spence Watson.

Greenock and Port Glasgow Tramways Co.

The meeting was held on Thursday of last week at the Electrical Federation Offices, Kingsway, Mr. W. L. Madgen presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review), said that there had been no addition to the capital account during the year. The investment reserve account had been increased from £10,646 to £15,054. The balance carried to the profit and loss account was rather more than £2,000 in excess of the previous year, the figure being £8,780, as compared with £6,765. That enabled them to pay a dividend of 3 per cent. as compared with 1 per cent., and to make provision for writing off the small loss incurred in the sale of the Diesel engine plant. The traffic receipts showed an increase of over 10 per cent. due to improved trade, and that would have been increased upon but for the unfortunate local labour dispute in September, which lasted nearly to the end of the year. Power and running expenses showed a small increase consequent upon the increased miles which had been run. Since the last report the period for the revision in the price paid for electricity to the Greenock Corporation arrived, viz., May 15th, 1910. The price to be paid for the next four years was settled amicably between Mr. Bond, the then chairman of the company, and the secretary on the one hand, and the provost and borough engineer of the Corporation on the other. The effect of the negotiations had been that they expected to effect a saving of about £350 a year in the cost of working. The local labour dispute having been settled, the effect was immediately reflected in the traffic receipts of the company, which up to date were better than they had been in any previous period, even including 1905 and 1906, which were exceptionally favourable.

Mr. C. Shirreff Hilton seconded the motion, and the report was adopted.

Rhondda Tramways Construction Syndicate, Ltd.—The directors' report states that the net profit earned by the Rhondda Tramways Co. was £19,388, plus £543 brought forward. An interim dividend of 3 per cent. (less income-tax), amounting to £7,062, was paid in August last, leaving a balance of £11,043. The directors recommend a final dividend of 3 per cent., less income-tax, amounting to £7,062, making the distribution for the year 6 per cent., £3,980 is to be carried forward. The meeting was held in London yesterday.

Guildford Electricity Supply Co., Ltd.—For 1910 the net revenue account shows a balance of £1,071. After paying 5 per cent. on the ordinary shares, £371 is carried forward.

North of Scotland Electric Light and Power Co., Ltd.

The directors report that satisfactory progress has been made during the year ended December 31st, 1910. The gross profit, including £225 brought forward from last year, is £5,322, and after meeting interest paid on debentures and loans amounting to £2,918, and writing off £31, part cost of street lighting alterations, there remains a net profit of £2,373. It is proposed to carry £1,600 to renewal reserve account, and the balance of £773 forward to the next account. £855 of debenture stock has been issued during the year.

	Montrose.	Brechin.	Inverness.
Units generated	257,549	184,668	460,100
Quantity sold.			
Public lamps	60,050	30,178	—
Private consumers by meter ..	144,804	103,685	401,627
Total sold	204,854	133,863	401,627
Used on works	47,787	44,162	50,261
Total acounted for	252,641	178,025	451,888
Quantity not accounted for	4,908	6,643	8,212
Total max. supply demanded, kw..	151·5	108·6	284
Lamps connected, Jan. 1st	20,153	17,841	21,870
Lamps connected, Dec. 31st	22,175	18,576	25,846

Lymington Electric Light Co., Ltd.—Mr. Keppel Pulteney presided on March 15th at the annual meeting, and he moved the adoption of the report, which showed that the total units sold had increased from 124,198 to 127,925, leaving a trading profit of £1,596, and after paying debenture and loan interest, a balance of £1,053, which admitted of a 5 per cent. dividend, with £700 placed to reserve, and £32 carried forward. He said that although they had sold more units, their working expenses showed a reduction. They had obtained a five years' contract for the public lighting. Mr. J. C. Wigham seconded the motion, and the report was adopted.

Winnipeg Electric Railway Co.—The directors have declared a quarterly dividend at the rate of 10 per cent. per annum.

Official Announcements re Companies.—The following companies will, unless cause is shown to the contrary, be struck off the Register, and will accordingly be dissolved :—

Eaton Telephone Disinfector Co., Ltd.
Electro-Brass Co., Ltd.
Garonne Valley Electric Supply Co., Ltd.
Mercedes Brougham and Landaulette Co., Ltd.
Mercedes Cab Co., Ltd.
Midland Electric Laundries, Ltd.
Turbinal Tubeless Boiler Syndicate, Ltd.

Stock Exchange Notices.—The Committee has appointed special settling days as under :—

Wednesday, March 29th.—Bell's United Asbestos Co., Ltd.—£75,000 5 per cent. debentures of £100 each (Nos. 1 to 750 registered); further issue of 19,373 shares of £1 each, fully paid (Nos. 120,001 to 139,373).

Thursday, March 30th.—Shawinigan Water and Power Co.—Further issue of $500,000 capital stock in shares of $100 each.

Wednesday, April 12th.—London Electric Railway Co.—Speyer Bros.' scrip certificates, fully and partly paid, for £1,250,000 4 per cent. preference stock.

And ordered the undermentioned securities to be quoted in the Official List :—

Bell's United Asbestos Co., Ltd.—£75,000 5 per cent. debentures of £100 each (Nos. 1 to 750) (registered).

Shawinigan Water and Power Co.—Further issue of $1,500,000 capital stock, in shares of $100 each.

Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

Marconi's Wireless Telegraph Co., Ltd.—Further issue of 22,735 ordinary shares of £1 each, fully paid, Nos. 394,191 to 416,925.

To appoint a special settling day in—

Bell's United Asbestos Co., Ltd.—Further issue of 19,373 shares of £1 each fully paid, Nos. 120,001 to 139,373.

And to allow the following securities to be quoted in the Official List :—

Telephone Company of Egypt, Ltd.—Further issue of £50,000 4½ per cent. debenture stock.

Isle of Wight Electric Light and Power Co., Ltd.—The directors report that, including £121 brought forward, the accounts for 1910 show a profit of £12,488. After providing for debenture interest and the preference dividend, there remains £5,186, out of which the directors recommend that £3,500 be added to the renewal fund and £1,000 to the reserve fund, leaving £686 to be carried forward.

Consolidated Gas, Electric Light and Power of Baltimore.—The directors have declared a dividend for the quarter ending 31st inst. of 1¼ per cent.

Prospectuses.—*British Columbia Electric Railway Co., Ltd.*—The subscription list is open until to-morrow (Saturday) for £600,000 4½ per cent. perpetual consolidated debenture stock at 100 per cent. The proceeds are required for the general purposes of the company and to meet extensions of the undertaking in all departments.

An issue is now being made by Messrs. Higginson & Co. of $1,250,000 Bell Telephone Co. of Canada 5 per cent. bonds at 103 per cent. The list closes to-day.

Falkirk Electric Construction Syndicate, Ltd.

Mr. G. M. Brown presided on March 1st at Edinburgh over the sixth ordinary general meeting of this company. He said that last year's forecast of an improvement in the future affairs of the company had proved correct, and they proposed to pay a dividend of 4 per cent. on the share capital, after setting aside £2,538 for depreciation, and carrying forward £2,291. The revenue from the main line section of the tramways for the year was £13,459, as compared with £12,771 for the year ending October 16th, 1909, an increase of slightly over 5 per cent. To these receipts there fell to be added the revenue from the first full year's working of the Laurieston section amounting to £2,751, making, together with advertising and sundries, gross receipts over the whole system of £16,473, as compared with £13,477 for last year. The first quarter of the new financial year showed increased receipts of £240 odd, as compared with the corresponding period of last year, and every hope was entertained that this rate of increase would be maintained. The total traffic receipts had amounted to 8·38d. per car-mile, as compared with 7·86d. per car-mile for the previous year. The operating expenses during the year had been further reduced, and notwithstanding the extra mileage run owing to the working of the Laurieston extension, and the additional revenue of nearly £3,000, there had only been an increase in the working expenses of £477. The operating costs per car-mile had amounted to £4·94d., including secretarial, head office and legal expenses, directors' and auditors' fees, &c., as compared with 5·62d. for last year; £550 paid to the Caledonian Railway Co. for working the two bridges over the Forth and Clyde Canal had also been included in arriving at the above figure, and without this heavy and, for a tramway company, exceptional obligation, the total costs would only have amounted to 4·66d. per car-mile. Considerable credit was due to the general manager and staff for the manner in which the system had been operated during the year, and for the economies which had been effected without detriment to the efficiency of the system. The sum set aside for depreciation was exceptionally heavy, but they had decided, in view of the satisfactory nature of this year's accounts, to write off the whole balance of the special equipment renewals account this year, instead of carrying forward a proportion to next year, as was originally intended. In future a more conservative figure would be taken, thus leaving a larger available profit for distribution.

The report was adopted.

City of London Electric Lighting Co., Ltd.

The annual meeting was held on Wednesday of last week at Salisbury House, E.C., Mr. J. B. Braithwaite presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 393), said the capital account was the same as it had been since 1901; the whole of the capital outlay that had been required during the past 10 years having been provided out of revenue. The revenue from private lighting last year had amounted to £244,916, as against £251,285 in 1909, a decrease of nearly £7,000. The revenue under contracts was about the same; meter rentals showed a slight increase; rents receivable were about the same, the total result being that the revenue for the year was £280,115, as against £286,303, a decrease of about £6,000, and as they had a decrease in the amount brought forward from the previous year of £1,736, the total reduction was £7,768. They had been able to recoup part of that by economies in working expenses amounting to £3,633, leaving a net decrease of £4,135. The drop in the gross revenue on lighting account was fully accounted for by the early Easter last year, the bright weather experienced in the first quarter of the year, and the remarkable absence of fogs in the last quarter. He did not think they need fear that the decrease in the lighting revenue was the beginning of a very big drop. As he told them last year, the change from the carbon to the metallic-filament lamp was one which would take some time to make its full effect felt, although there was no doubt that its ultimate effect would be for the benefit of the electric lighting industry. It would appear from the decrease last year that the full effects of the introduction of the metallic-filament lamp had now been felt, because so far during the current year every week had shown an increase in the revenue from lighting. The revenue from power, of course, went on continuously. It was also noticeable that the decrease in the revenue from lighting was very much greater in the first quarter of the year than in the subsequent quarters, which was another indication that they had felt the full effect of the introduction of the new lamp. The power and heating business brought in an additional £2,750, so that the actual loss in gross revenue was only £6,032. They had saved £5,092 in coal, which was extremely satisfactory. That was partly due to the economisers which he told them last year they were putting in. The net reduction in the working expenses was £2,124, so that as a result of the year they had £4,135 less to deal with than at the end of 1909. In 1909 they placed £8,264 out of profits to the dividend equalisation account, and they took £1,736 from the carry forward to make up an even figure of £10,000. This year, after paying the same dividend, they put £4,000 to the equalisation fund and added £1,988 to the carry forward, so that in spite of the decrease in their net results they were still in a very strong and very satisfactory position. He might be asked why they had only put £4,000 to the equalisation of dividend account, and had raised the carry forward by £1,988. The reason was that they had now raised the dividend equalisation account to £14,000, which was approximately 2 per cent. on the ordinary stock, and having raised the fund to that figure, they felt that if the results of the current year should turn out satisfactory they might be justified, with that fund behind them, in increasing the dividend. That, of course, depended entirely upon the results of the current year. They had that equalisation fund, so that whenever they took a step forward in the dividend they might do so with a reasonable anticipation of its being maintained. The rise in the carry forward was also an additional reserve. They considered £20,000 an adequate carry forward, and any sum above that was available for equalisation of dividends, or for any other purposes of the kind. It might be assumed from the report that the business was not increasing, but that was not the case. They had had an increase of 538 customers; a larger number than in any year since 1901. From 1891 to 1909 they had written off no less than £423,770 from works which had been dismantled and replaced, and last year they had written off a further £44,269, thus maintaining the sound and conservative policy of writing off the whole cost of any machinery or plant which they got rid of. They still had a balance of over a quarter of a million available for writing off plant in the future, as it should become obsolete. There was an item—public lighting suspense account—£2,271, which represented the cost of the demonstrations they were making at the present time in the City, and which awaited the judgment of a Special Committee of the Corporation. The company's financial position was approximately £16,000 stronger than it was this time last year, as their loan at the bank was down by £9,000, and their investments had increased by £7,000. One unfavourable feature was the steady rise in rates. They were already paying over £20,000 a year in rates and taxes, and when the new assessment was fully operative, that item would be considerably increased. They were fortunate in not having to spend money on Parliamentary expenses. The Bill introduced by the District Railway and the London Electric Railways for the acquisition of the Lot's Road power house originally contained some objectionable clauses, but they had been withdrawn, and the electric supply companies had withdrawn their opposition to the Bill. It would be necessary for them to watch the building of the new St. Paul's bridge, for as at present scheduled the bridge would take off a portion of their generating works. He had very little doubt, however, that they would be able to arrange matters satisfactorily without going to Parliament.

Mr. F. W. Reynolds seconded the motion, and the report was adopted.

Bournemouth and Poole Electricity Supply Co., Ltd.

The annual meeting was held on Thursday of last week, at the offices, Moorgate Court, E.C., Mr. A. H. Sanderson presiding

The Chairman, in proposing the adoption of the report (see Electrical Review, page 394), said that the capital account remained unchanged. The loan account stood at £19,250, as against £9,200. Those loans had been arranged for temporary purposes on satisfactory terms. Reserve for depreciation stood at £26,912. £9,256 had been expended during the year on capital; that expenditure was again less than in the previous year, when it was £1,070. That was distinctly a satisfactory feature, and no less than £6,738 of the money spent last year was on mains, and £1,516 on meters, &c., for new customers. In an undertaking such as theirs with its extensive area of supply, where houses were springing up continually in all directions, and new districts were being rapidly developed, it was inevitable that a comparatively large expenditure should be made year by year on mains. They were exceptionally fortunate in possessing Parliamentary powers for the supply of electricity to an area offering such favourable opportunities for the investment of their capital. Another satisfactory feature was that the generating plant at their stations was sufficient for their present needs, and it was not probable that they would be called upon to spend any additional large sums on generating machinery for some years to come. A further £4,000 had been advanced to the Richmond Co. on loan during the past year. The revenue would give them no cause for dissatisfaction. There was an increase of £570 in the receipts from sale of current and meter rentals. Interest, discounts, and transfer fees were about the same, but he was glad to say there was an increase of £320 in the profit shown on trading account, the total of £694 being nearly double the profit of 1909. That was undoubtedly due in a great measure to the handsome showrooms which they had established, where daily demonstrations took place of the use of electricity for domestic purposes. Although it was very pleasing to find that they had made a larger profit in that department, their principal object in maintaining those rooms in such an efficient manner, was primarily to extend the use and popularise the supply of electricity throughout the area for lighting, heating and power purposes. Dividends and interest received showed an increase of £172, due to the increased amount they had received from the Richmond Co. in respect of their holding in that company and loans. On the debit side of the account there was a decrease of £378 in the item of coal, oil, waste, &c. Those decreased expenses were extremely satisfactory, and contributed largely to the favourable results they were able to show. The net result was that the total debits on revenue exceeded those of last year by only £57, in spite of the increased business, and he felt sure they would duly appreciate that result. Interest on debenture stock and on temporary loans had increased by £315, due to the necessity for the increased loan from the bankers. When they considered the whole position, and recalled that an additional expenditure of over £9,000 had been incurred on capital account during the year, they would appreciate the care which had been given to the company's finances. They had written off out of last year's revenue £1,627 in respect of leasehold and special redemption funds, £412 off suspense account, £4,500 for depreciation, making altogether £6,539. With regard to

the Richmond Co., he was pleased to record that it had maintained its position; the same rate of dividend had been declared, and the company continued to make satisfactory progress. He trusted the shareholders would agree with the directors in regarding the improved position as shown in the accounts as very satisfactory. There had been an increase of £1,143 in gross revenue, and practically the whole of that amount had been retained in the net revenue account. An increased sum had been placed to reserve. There was an increase in the carry forward, and the dividend was maintained at 5½ per cent. As to the general progress of the business, the increase in lamps applied for was equivalent to 13,413 30-watt lamps, making the total of lamps applied for up to December 31st last equivalent to 236,569 30-watt lamps; 456 new customers were connected to the mains during the year, and there was an increase of 88,000 in the units sold. He considered those figures were satisfactory in view of the difficulties they had had to encounter during the year, and the prospects for the present year were very encouraging. The connections to the mains since the close of the year were equivalent to 3,462 30-watt lamps, showing an increase of 429 on the corresponding period of the previous year. On December 31st they had a total of 5,289 consumers connected to their mains, and since then they had added 72; and they now possessed some 207 miles of distributing mains in Bournemouth and district. With regard to the metallic-filament lamps, he ventured to say last year that the very considerable economies which these lamps would make to consumers would not in the long run prove detrimental to the electric lighting interest, and he saw no reason to alter that view. They had felt the effects of the introduction of those lamps very acutely in the past, but he thought they had now seen the worst of any damaging effect which they were likely to cause in their revenue. Eventually, he believed, the lamp would prove a blessing in disguise, and therefore it should be cordially welcomed by the company rather than feared.

Mr. J. A. Hosker seconded the motion, which was adopted.

Madras Electric Tramways (1904), Ltd.

Mr. W. S. B. McLaren, M.P., presided, on March 16th, at Dashwood House, E.C., over the seventh annual general meeting of the above company.

In moving the adoption of the report, the Chairman said the accounts for 1910 again showed a marked improvement upon the preceding year. The balance at the credit of running account, after providing as usual for all expenses and costs of maintenance in Madras, amounted to £14,292, being an increase on 1909 of £2,300. This improvement arose (1) from an increase in traffic receipts, and (2) reduced costs of operation. Regarding the latter, as they were aware, their generating plant had become inadequate, and the board, instead of incurring further capital outlay, resolved to accept an offer for the supply of current from the Madras Electric Supply Corporation, Ltd. This supply was commenced on January 12th, 1910, and he was convinced that the contract would prove advantageous to both companies. The only item on the debit side of the profit and loss account calling for special observation was the provision of £5,000 for depreciation and renewals, which compared with £3,000 for 1909. He indicated last year that it was the intention of the board to augment the depreciation and renewal fund as liberally as circumstances would permit, and it would interest them to know what the programme of renewals was. By the end of 1912 they hoped to have relaid with 90-lb. rails all the permanent way, except two short sections on which traffic was comparatively light, and on which the lighter rails now laid would be quite serviceable for a few years longer, and, in addition, the re-building of the old car bodies and fitting up-to-date controllers would have been completed. These renovations would involve a further debit to depreciation and renewal account of about £16,000, but they were very sanguine that with the balance of £3,814 at the credit of the account, it would be possible to meet this outlay out of revenue and maintain the present dividend of 2 per cent. on the ordinary shares. When these renovations had been completed, at the end of 1912, the prospects for the ordinary shareholders would be very good. The usual instalment of the debenture stock sinking fund had been provided out of revenue, and the amount now standing at the credit of reserve amounted to £3,091. The net balance on profit and loss account was £4,591 to which had to be added the balance of £663 brought forward from last year, making a total available for dividends of £5,254. The directors recommended that this profit be applied in paying:—(1) A fixed dividend of 4½ per cent. on the preferred ordinary shares (whereof a moiety was paid on September 30th last); (2) an additional 1 per cent. on these shares; and (3) a dividend of 2 per cent. upon the deferred ordinary shares. These dividends would absorb £4,308, leaving a balance of £946. Of this balance £93 had to be carried to the preferred ordinary shares surplus dividend account, leaving £854 to be carried forward. In addition to the dividends mentioned the surplus profits to December 31st, 1910, amounting to 3·5d. per share, would be distributed among the preferred ordinary shareholders. Turning to the balance-sheet, the additions to property account during the year, amounting to £6,486, included additions to buildings and workshop machinery and four new cars. The item of stores and stock-in-trade was inflated by the value of permanent way material, &c. (for renewals in 1911) in transit at the end of last year. On the other side, £1,643 had been debited to depreciation and renewal fund. The actual amount spent on renewals, however, was £3,772, but they were able to bring in certain items to the credit of that account, reducing the debit to the sum appearing in the balance-sheet. Notwithstanding that there had been no increase in track mileage, the traffic receipts showed a satisfactory increase of 4·82 per cent, on 1909. The number of passengers carried was 13,516,380, being an increase of 4·97 per cent. upon the previous year. As indicated in the last annual report, they applied for an Order to construct over 3 miles of track. This order had been the subject of protracted negotiations with Government and the Municipality of Madras, but he was now glad to report that, on 7th inst., they received a cable intimating that it had been passed. The plans would be submitted to the Municipality without delay, and it was their intention to proceed with the work as soon as possible. Anticipating the passing of this order, the capital of the company had been increased to £200,000, consisting of 25,000 6 per cent. cumulative preference shares of £5, and 15,000 ordinary shares of £5 each. The preferred ordinary shares, which were entitled to a fixed dividend of 4½ per cent. and one-third of the surplus profits, had been converted into 6 per cent. cumulative preference shares, and the deferred ordinary shares had been converted into ordinary shares, the modifications taking effect as from January 1st, 1911. The capital required for the extensions would be raised, they expected, partly in 5 per cent. debenture stock and partly in preference shares, and they had no doubt that the extensions would prove remunerative.

Mr. A. M. Quill seconded the motion, and it was adopted without discussion.

In reply to a vote of thanks, the Chairman said they really had a most excellent business. Their profits were unquestionably going up, and he had no doubt whatever that, in course of time, not only would the 6 per cent. preference be a valuable security, but the ordinary shares would receive a considerable dividend, which would increase as years went on.

Underground Electric Railways Co. of London, Ltd.

The half-yearly meeting was held on Wednesday last week at the offices, Electric Railway House, Broadway, Westminster, Sir Edgar Speyer, Bart., presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 304), said that the income from investments had increased by £17,000, as compared with the corresponding half-year of 1909. General expenses had been reduced by nearly £700. After alluding to other items in the accounts, he said that the report and speeches of the chairmen of the Metropolitan District Railway, London Electric Railway, and the London United Tramways Companies had dealt so fully with the affairs of these companies, that it was not necessary for him to add anything to what had already been said, except to record with satisfaction that all these companies had shown encouraging development, especially the Metropolitan District Railway, and the lines, owing to the excellent service given, enjoyed increasing popularity. He would like to take this opportunity of contradicting most emphatically a statement made in several quarters to the effect that their Underground Railways could not handle any substantially larger number of passengers than they now did. This statement was entirely without foundation. On the London and Electric three and four-car trains were being worked, although the railway was designed for trains of nearly twice that number of cars. On the District nearly the whole of the trains could be worked with additional carriages, and by alterations to the signalling system the number of trains per hour considerably increased. Experts were now considering schemes having for their object not only an increase of speed, but also an increase in the number of trains per hour on this railway. Many millions more passengers could be carried from year to year on these railways, and no step would be neglected which would bring about such a result. In the half-year under review they had maintained the dividend at the rate of 1 per cent. per annum on the income bonds, and the outlook justified the hope that the distribution would be somewhat increased in the near future. The expectation expressed by him six months ago that the Hampstead Tube would show increases after November, 1910 (that was a full year from the electrification of the L.C.C. Hampstead and Highgate Tramways) compared with the corresponding period, has been fully realised. The Bills before Parliament had already been dealt with by the chairmen of the District and London Electric and of the London United Tramways. These Bills sought power for two extensions, one on the Bakerloo line from Edgware Road to Paddington, and another on the Charing Cross line, from the Strand to the Embankment, also for new railways at Earl's Court on the District line, for the more convenient working of the trains at that point. The Bills also sought power to sell electrical energy from the Lot's Road station to various railways and tramways, and in this way utilise the surplus current available at Lot's Road. The Tramways Bill sought power for the extension of time for the electrification of the Kew Road line to Richmond. With regard to the proposed sale of the Lot's Road power station, which was now owned by this company, the railway companies were very desirous of owning the power station from which they obtained the supply of electrical energy for working the railways. They now owned all the sub-stations and cables, for which they paid approximately £800,000. The scheme provided for the formation of a joint committee of the two railways, which would be empowered to issue rent charge stock for the purchase of the power station. No definite figure had been arranged between the companies, but this company would be willing to sell the station provided satisfactory terms could be come to. When the railway companies obtained statutory power for the purchase of the power station, the terms of the purchase must be approved at a general meeting of each of the three companies, and by the trustees for the bondholders and debenture-holders of this company. Since the report was issued the company had through the sale of £1,250,000 London Electric preference stock from its

treasury, been able to announce the redemption on September 1st next of the whole of the outstanding issue of £1,000,000 prior lien bonds. Through this redemption the 4½ per cent. bonds of 1933 become a first lien on the securities deposited by the Underground Co. under the trust deed, and the lien of the income bonds was also advanced proportionately. This transaction was a step in the right direction, and the announcement was already having the effect of enhancing the credit of the company, as was evidenced by the higher market prices of its securities. The award of the Arbitrator in the dispute between themselves and the British Westinghouse Co. with regard to the eight turbines supplied by them for the Lot's Road power house had now been made, and he was glad to be able to make the important announcement that it was entirely in their favour. The British Westinghouse Co. claimed from them over £83,000 for the balance of the contract price of the turbines and turbo-alternators supplied by them. They resisted their claim on the ground that the turbines were defective and not up to contract, resulting in such an excessive coal consumption that, after lengthy endeavours on their part to improve them, they had to scrap their turbines and buy Parsons' turbines, the purchase and installation of which cost them over £78,000. They also counterclaimed for damages, mainly owing to the extra amount of coal consumed. The Arbitrator had awarded that the British Westinghouse Co. was not entitled to recover any sum from them in respect of their claim, so that they retained the £83,000, which covered the cost of the new Parsons' installation, and he had also awarded them over £15,000 by way of damages and the costs of the arbitration in addition. It gave him much pleasure to inform them of the successful result of this litigation, and of the fact that the power house was now in a condition of such efficiency and completeness that it was a source of real pride and satisfaction to those upon whom had fallen the arduous duty of its construction and equipment. The British Westinghouse Co. would, he understood, seek to upset the award, but the board were advised that the award was good. During the year 1910 the Metropolitan District, the London Electric and the London United Tramways carried the enormous total of 230,000,000 passengers, and he thought they might look forward to a substantial increase in this number for the current year. The Coronation festivities would undoubtedly attract a large number of visitors to London, and the railways and tramways were making preparations to deal with a record traffic.

Lord George Hamilton seconded the motion, and the report was adopted.

Scarborough Electric Supply Co., Ltd.

At the annual meeting held on March 16th, Mr. A. A. Campbell Swinton, M.Inst.C.E., denounced the methods of the local income-tax collectors. Referring to the recovery by the company of £133 income-tax, he said the income-tax people absolutely refused to allow them to deduct the amount they put aside for depreciation from their accounts before charging income-tax. It was pointed out that this was done at other places, but the income-tax people refused to admit that, and the company taking a strong stand, it went so far as to threaten to put brokers in next day. The money was paid under compulsion, and the matter carried to Somerset House, with the result that they got the money back. Mr. Swinton added: "It is a pure game of bluff, and it is a monstrous thing that Government officials, holding quasi-judicial positions, should play games of bluff. I know of two other similar cases where the local income-tax people have tried and have successfully induced people to pay a great deal more income-tax than they should have paid. It was only under great pressure, and bringing the influence of the head people at Somerset House to bear on the matter that the money was refunded. I speak with some feeling, because I think it is a monstrous thing." In regard to the position of the Scarborough Tramways Co., Mr. Swinton said that the amount of energy supplied during the year for general lighting and other purposes had increased, but the total amount supplied for all purposes had fallen, owing to the tramways company having discontinued its winter service, and its consequent failure to take its contract supply of electrical energy. He was not a director of the tramways company, but happened to know what was going on, and the position was really rather serious. When the tramways were started, some few years ago, the Electric Supply Co. put up special plant at considerable cost for the purpose of supplying the tramways company with energy. They had to put up special plant, because the Tramways Company wanted the continuous current, and the other supply in the town was alternating current. The Tramways Company was paying the Electric Supply Co. something like £1,600 a year. If the tramways ceased to run altogether, they would be minus that £1,600 a year. They supplied some 234 H.P. of motors in the town off the same plant that supplied the tramways, and that continuous-current motor load was increasing fairly rapidly. Still, the continuous-current plant they had in store was too large for any motor load that was likely to arise in the near future. If, therefore, the tramways ceased to run, it would be a serious matter for that company, and he believed the Board of Trade had been approached by the Scarborough Corporation with that end in view. On the other hand, he happened to know that the tramways company had determined, if they were allowed to, to commence running again next month, and he believed if they started again their idea was to run continuously through next winter. He hoped the action of the Corporation in approaching the Board of Trade would not lead to the Tramways Company stopping altogether, and to the Electric Supply Co. losing, at any rate for some years, a very considerable income. He understood there was some idea of a tramway company arrangement superseding the trams by some form of railless traction, using overhead wires and electrical energy. He would point out, however, that powers to make a change of that kind could only be obtained from Parliament, and it was too late to obtain such powers this year. Consequently that, with the time that would be taken up by the engineering change involved, would mean that such railless traction could not possibly commence running for something like three years from the present.

Brompton and Kensington Electricity Supply Co., Ltd.

The annual meeting was held on Thursday last week at Winchester House, E.C., Mr. H. R. Beeton in the chair.

In proposing the adoption of the report (see Electrical Review, page 440), the Chairman said that the extension of business measured by customers and lamps connected was sufficiently satisfactory, due largely to the development of the demand for electricity for heating and cooking mainly through the instrumentality of their showrooms, but the gross and net receipts still showed a slight falling off. The increased capital expenditure during the year amounted to £3,560, represented chiefly by £1,193 on mains, and £1,184 on meters. The expenditure on mains was accounted for by the growth of business, but that on meters was largely exceptional, and to that extent was due to the substitution of up-to-date for obsolete instruments whereby the company would derive benefit from the more accurate measurement of its consumers' consumption. The installation of the new switchboard, completed early in the year, was giving complete satisfaction, and they were now installing their first turbine unit from which they looked for a favourable effect on their expenses. The coal cost had been slightly more, notwithstanding the fewer units produced, in consequence of their having to pay a rather higher price for a somewhat inferior coal, as the result of the disturbance of their supply by the lamentable strikes (provoked by well-intentioned but misguided legislation). They had also had to purchase a rather larger water supply owing to the disappointing yield from their well. The increase in rates and taxes was mainly due to their assessment for income-tax, against which they were appealing, and he hoped that the estimated appropriation entered in the accounts might in the end prove to be in excess of their liability. In this connection he was glad to report that they had obtained an abatement of their assessment for rates by which the company would benefit to the extent of upwards of £200 per annum during the next quinquennium. The increase in management salaries was due to the greater work entailed by the changed conditions of the business and to the recognition by the board of the long services of some of their senior officers. On the credit side of the revenue account there was a loss of £231 in receipts, notwithstanding a slight improvement in the average price obtained, due, mainly, to the closing of the Earl's Court Exhibition. He was pleased to say, however, that this Exhibition would be reopened this year, and they would, therefore, recover the business which they had enjoyed in previous years. The trade at their new showrooms had fully equalled their expectations, and the profit on it not only more than covered the expense involved, but it had resulted in a large part of the increase of business which they had obtained during the year. The growth attending this branch of their enterprise had obliged them to take the lease of the entire premises at 254, Earl's Court Road, and they now included a fully-equipped electrical kitchen, which was in constant operation and where daily demonstrations in cooking were given for the benefit of consumers. He would again invite shareholders and their friends to visit these showrooms, where they had what was, by general consent, the most complete and up-to-date equipment for electrical heating and cooking to be seen in London. Their annual contract system had been well taken up, with results which they had no doubt would be mutually advantageous to their customers and themselves. For the first time for some years their output during January and February showed an improvement over the corresponding period in the previous years, and he felt justified in predicting a more hopeful prospect than had confronted them for some years past.

Mr. W. R. Davies seconded the motion.

Replying to a Shareholder, the Chairman said that they had suffered, in common with other companies, very seriously from a falling off in consumption in consequence of the introduction of the metallic-filament lamp. Fortunately, however, they had extended the business in other directions, and they had now reached that position in which the gain outbalanced the loss.

The report was adopted.

Newmarket Electric Light Co., Ltd.—The directors' report for 1910 shows that 1,545 8-C.P. lamps have been connected to the mains, making the total at December 1910, 25,988 lamps. Applications for a further 138 lamps have been received this year. The whole of the works have been maintained in perfect working order. The profit on the year's working, added to £127 brought forward amounts to £2,528 which, after providing for debenture and other interest, £757, leaves a balance of £1,771. The directors recommend the payment of a dividend of £4 per cent.; that £650 be carried to reserve for renewal of plant, and that the balance be carried forward.

Metropolitan Electric Tramways, Ltd.—The directors have declared a dividend of 5½ per cent. on the ordinary shares for the year to December 31st.

Fife Tramway, Light and Power Co.

Mr. Low, who presided at the annual meeting on Monday, March 13th, stated that the results of the year's working were quite up to the expectations of the directors. The continuation of the Kelty branch had fully justified expectations, both in respect of revenue earned, and as a feeder to the main system. Statistics as to the traffic showed that 411,300 car-miles had been run, and 2,090,270 passengers had been carried. Referring to the extension of the present system to Rosyth, Inverkeithing and Lochore, the chairman said it was proposed to proceed with the Lochore section during this year, and he hoped to be able to announce at their next annual meeting that this line was completed, and proving as useful and remunerative as their other lines. Regarding the power company, which would some day become the biggest part of their undertakings, they might remember that when they met a year ago he stated that, while it provided no revenue to them for 1909, they expected a good return for the future. The forecast had been justified, for it would be seen from the accounts that they had brought in for the past year a profit of £2,200, after having extinguished a debit balance of £470. The outlook for the power supply was very good indeed, and the directors proposed to adopt a progressive policy. Substantial extensions to their feeder and distributor systems would be laid down year by year, but capital commitments would only be incurred when they might expect a revenue sufficient to give an immediate and reasonable return. A contract had been signed by the power company to supply all the electricity required by the Wemyss and District Tramways, and the necessary transmission lines were being laid for this supply. Additional generating plant to the extent of 2,500 H.P. was being installed at the power station. This work would be completed in about four months' time, and the company would then have sufficient plant installed to enable them to sell double the present output, and have in addition a very large reserve plant as a stand-by. He moved the adoption of the report, which was agreed to.

An extraordinary general meeting followed, and passed the necessary resolution to increase the share capital by increasing the authorised preference shares to the extent of £25,000, and the ordinary shares to the extent of £25,000.

Mr. Geo. Balfour outlined the year's probable development, and made it clear that any money expended would be dividend-earning from the date of the completion of the work, and would, in addition, have a large future earning capacity.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

The directors' report for the year ended December 31st, 1910, states that the connections to the company's system at the end of the year amounted to 139,776 H.P., which, compared with the previous year's figure of 129,219 H.P., shows an increase of 10,557 H.P. The profit for the year, including the balance of £2,924 brought forward, amounts to £110,702 (£104,888 in 1909), against which has been charged interest on debentures, loans, &c., amounting to £31,777 (£23,589), leaving an available balance of £78,925 (£81,299), out of which the directors recommend a dividend of 5 per cent. for the year on the preference shares (of this an interim dividend of 2½ per cent. was paid in July last, amounting to £17,187), £34,375; a dividend of 4 per cent. for the year on the ordinary shares (of this an interim dividend of 1½ per cent. was paid in July last, amounting to £10,312), £27,500; the transfer to depreciation account of £15,000 (£16,500 for 1909); carrying forward £2,050, against £2,924 for 1909; the reserve account stands at £6,994; the general depreciation account will, when increased by the above transfer of £15,000, stand at £115,000. This is in addition to the amount of £150,000 written off in 1906 in reduction of capital expenditure. The unsettled condition of the coal trade in the early part, and the lock-out of the boilermakers in the latter part of the year adversely affected the business of the company. Expenditure on capital account amounting to £110,282 had been incurred during the year. This expenditure was mainly in connection with the new power station at Dunston and for extensions of the distribution system. A provisional order authorising supply of electrical energy by the company in that portion of Kenton now included in the City and County of Newcastle-upon-Tyne has been applied for. The pension and benevolent funds for the benefit of certain classes of employés of the company, referred to at the last meeting, have been brought into operation as from January 1st, 1911. The directors record the death of their colleague, the Right Hon. Robert Spence Watson. Mr. Gibson, for reasons of health, does not seek re-election, and the directors recommend the appointment of Mr. Frederick Stirling Newall to a seat on the board. Dr. Spence Watson and Mr. Gibson were both original directors of the company, the latter holding the position of chairman up to March, 1901. To their careful supervision and valuable assistance, especially in its earlier years, the success of this company's undertaking has been largely due.

United Alkali Co., Ltd.—The directors report a net profit for 1910 (after paying £133,000 for debenture interest) of £328,966, plus £62,343 brought forward. £15,003 is transferred to debenture redemption fund account, £25,000 is placed to reserve, and £50,000 to the depreciation portion of the reserve fund. A dividend of 4s. per share for the year is to be paid, carrying forward £58,699.

Gateshead and District Tramways Co., Ltd.

The directors' report for the year ended December 31st, 1910, states that the total revenue amounted to £53,608, and after deducting all expenses chargeable to revenue, including repairs and maintenance, interest on mortgages, and £2,661 placed to provision for renewals, there remains a profit on the year's working of £21,309 plus £840 brought forward, making £22,149. Out of this there is to be put to reserve fund £4,500, and to sinking fund for redemption of mortgages, £1,945. The dividend for the year on £12,610 6 per cent. preference shares requires £757, and dividend for the year on £120,000 5 per cent. preference shares £6,000; a dividend on the ordinary shares at the rate of 6 per cent. per annum is to be paid requiring £8,100, leaving £848 to be carried forward. Short extensions of the Bensham and Wrekenton routes were constructed and opened for traffic in October, and the doubling of a portion of the Low Fell route was also completed. The expenditure chargeable to the capital account during the year amounted to £14,658, making the entire capital outlay of the company in and upon the undertaking, £333,043. The trade of the district was in an unsettled condition during the past year, and it is hoped that with a continuance of the improved state of affairs now existing, the traffics will show a material increase during the current year. The undertaking has in all respects been maintained as in years past in good order and repair.

	1909.	1910.
Route miles—		
Single line	5·26 miles	5·32 miles
Double line	6·02 miles	6·79 miles
Passengers carried	11,970,022	12,061,249
Average receipts per passenger	1·03d.	1·03d.
Average expenditure per passenger	·57d.	·56d.
Proportion of expenses to receipts	55 %	54 %
Cars in stock	52	52

Slough and Datchet Electric Supply Co., Ltd.

The directors report that the capital expenditure at the end of the year 1909 was £48,403, and during last year a further sum was expended on capital account amounting to £753, bringing the total up to £49,155. The following table shows the progress of the company, the equivalent of 1,596 additional lamps of 8 C.P. having been connected last year:—

Year.	Lamps and motors connected.	Units sold.	Profit.
1908	15,231	368,778	£3,161
1909	16,380	335,983	£3,288
1910	17,976	332,295	£3,165

The total net profit available for distribution is £4,087. Out of this the directors purpose setting aside £750 to the depreciation fund, bringing it up to a total of £3,750. The directors recommend that out of the remaining net profit a dividend of 4 per cent. be declared, and also a bonus of 1 per cent. out of the surplus profits for the past two years, making 5 per cent., less income-tax. The mains, works, plant and machinery have been maintained in an efficient condition out of revenue.

Windsor Electrical Installation Co., Ltd.

The directors report that the capital expenditure during 1910 amounted to £4,202, bringing the total up to £89,313. The additional expenditure chiefly represents the cost of a 100-KW. Diesel oil engine, also the purchase of a piece of land adjoining the works for the erection of the necessary buildings. To meet this expenditure, the loan issued under the mortgage debenture has been increased, and the repayment will, in future, be increased from £1,000 per annum to £1,300 per annum. The profit for the year (including £421 brought forward) was £5,931; from this, the following sums have to be deducted: Debenture interest, £733; dividend on 5 per cent. preference shares, £1,108; depreciation, renewal and reserve fund, £1,500; directors' fees, £350; leaving a balance available for dividend on the ordinary shares of £2,240. Out of this the directors recommend that a dividend of 4 per cent., less income-tax, be paid on the ordinary shares, and that the balance of £356 be carried forward. During the year new lamps were connected equivalent to 1,769 of 8 C.P., the total connected to December 31st, 1910, being 47,641 lamps. The mains, works, plant and machinery have been maintained in an efficient condition out of revenue.

Electrical Distribution of Yorkshire, Ltd.

The directors' report for the year ending December 31st, 1910, again shows a satisfactory advance on the accounts of the previous year. The gross profit for the year is £751, against £238 for 1909, and for 1908, £37. After payment of interest on loans, &c., the profit and loss account shows a net balance of £515, against a net balance for 1909 of £184, and for 1908 of £13. The net profit of £515, with £197 brought forward, makes a total disposable balance of £712. A dividend at the rate of 2½ per cent. for the year (free of income-tax) is to be paid on the amount paid up on the ordinary shares, amounting to £203, there is to be placed to a reserve fund £400, and carried forward £109. During the year the company has laid down distributing mains in Castleford, Hipperholme, and Sowerby Bridge, and a considerable number of applications for energy have been received. There has also been continued and satisfactory development of other districts for which the company are the authorised undertakers.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Mar. 15	2,573	+ 147	41	57,626	+ 1,609	..	..
Ayr	„ 18	370	+ 1	44	12,946	+ 457	8	..
Bath	„ 18	1,332	— 67	11	7,100	— 170	..	..
Belfast	„ 19	8,210	+ 663	50	205,884	+14,433	37	..
Birkenhead	„ 19	1,994	— 19	50	54,930	+ 1,021	13·68	..
Birmingham Corp.	„ 11	14,375	+ 745	49	340,710	+ 9,312	56·9	..
Blackburn	„ 15	1,889	— 44	50½	53,093	— 886	14·62	..
Blackpool Corp.	„ 16	885	+ 6	..	55,539	+ 853	..	..
Blackpool-Fleetw'd	„ 18	492	— 12	11	2,689	+ 150	..	..
†Bolton	„ 12	2,302	+ 49	50	117,625	+ 2,614	26	..
Bournemouth	„ 15	2,759	— 187	49½	86,276	+ 4,718	21·9	..
Bradford	„ 11	9,978	+ 618	49	250,918	+11,877	54·81	..
Brighton	„ 19	1,492	— 76	50½	47,796	+ 291	9·5	..
Bristol	„ 17	10,804	+ 313	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	„ 10	432	+ 6	10	2,094	+ 2	3·65	..
Barnsley	„ 10	360	+ 1	„	1,628	+ 20	..	..
Barrow	„ 10	495	+ 42	„	2,259	+ 81	5·37	..
Cavehill	„ 10	129	+ 5	„	587	+ 69	..	..
Devonport	„ 10	875	+ 103	„	4,141	+ 260	8·85	..
Gateshead	„ 10	2,017	+ 85	„	9,740	+ 525	11·25	..
Gravesend	„ 10	365	— 18	„	1,718	— 58	6·5	..
Greenock	„ 10	1,274	+ 215	„	5,816	+ 1,023	7·25	..
Hartlepool	„ 10	429	+ 20	„	2,052	+ 103	6·72	..
Kidderminster	„ 10	172	+ 8	„	810	+ 22	..	..
‡Leamington	„ 10	267	— 45	„	1,260	— 111	..	..
Merthyr	„ 10	386	+ 14	„	1,768	+ 4	2·9	..
Metropolitan	„ 10	16,071	+2,078	„	74,159	+11,097	22	..
Middleton	„ 10	583	+ 29	„	2,741	+ 261	8·5	..
Mid. Joint Com'tee	„ 10	11,961	+ 567	„	55,500	+ 2,255	..	..
Oldham—Ashton	„ 10	1,071	+ 14	„	5,047	+ 192	9·13	..
Peterborough	„ 10	208	+ 19	„	958	+ 50	5·31	..
Potteries	„ 10	3,506	+ 431	„	18,275	+ 1,727	29	..
Rothesay	„ 10	87	+ 2	„	420	+ 16	2·75	..
Southport	„ 10	462	— 20	„	2,202	+ 72	8·17	..
S. Metropolitan	„ 10	1,424	— 88	„	6,667	— 113	..	..
Swansea	„ 10	2,140	+ 197	„	10,'42	+ 785	12·5	..
Tynemouth	„ 10	314	+ 41	„	1,444	+ 116	3·75	..
Weston-s-Mare	„ 10	35	— 3	„	164	— 19	3	..
‡Worcester	„ 10	485	+ 15	„	2,244	— 5	5·75	..
Wrexham	„ 10	179	+ 4	„	847	+ 24	..	..
Yorks. Wool. Dist.	„ 10	1,961	+ 105	„	9,687	+ 865	17	..
Miscellaneous	„ 10	391	+ 21	„	1,869	+ 88	..	..
Burnley	„ 18	2,417	— 40	..	..	..	11·78	1
Burton-on-Trent	„ 19	475	— 7	50	13,573	+ 290	6·64	..
Bury	„ 19	2,221	+ 130	50½	58,752	+ 1,246	22·5	..
Cardiff	„ 18	4,312	+ 261	51	113,061	+ 2,479	..	..
Carlisle	..	..	..	..	..	..	..	..
Chatham and Dist.	„ 16	1,499	— 6	11	8,063	+ 55	14·98	..
Cork	„ 16	865	— 48	11	4,519	— 149	9·69	..
Croydon	..	..	..	..	..	..	..	..
Darlington	„ 18	395	+ 37	51	10,198	+ 868	..	..
Darwen	„ 17	448	+ 2	50	11,893	— 373	4·36	..
Dover	„ 11	348	+ 7	49	10,599	+ 514	4·75	..
Dublin	„ 17	10,091	— 232	..	54,521	+ 538	54·25	..
Dundee	„ 15	2,189	— 40	45½	51,656	+ 505	15	..
East Ham	„ 18	1,945	+ 12	50½	51,840	+ 2,076	7·87	1
Exeter	„ 17	523	— 16	50	15,631	+ 665	5·5	..
Glasgow	„ 18	35,•96	+1,302	..	744,242	+42,383	97·75	2
Hastings	„ 19	1,466	— 91	..	..	..	..	..
Huddersfield	..	..	..	..	..	..	..	..
Hull	„ 18	5,•32	+ 177	50	139,311	+ 6,646	14·5	..
Ilkeston	„ 16	237	+ 8	50	6,357	— 244	..	..
Ipswich	„ 18	664	+ 20	50	20,564	+ 1,026	10·5	..
†Kilmarnock	„ 11	144	+ 10	43	6,516	+ 273	4·25	..
Lancashire United	„ 15	2,448	+ 10	..	12,810	+ 207	39	..
Leeds	„ 18	13,779	+ 443	50	353,534	+13,303	57	..
Leicester	..	..	..	..	..	..	..	..
Leith	„ 18	1,066	— 18	43½	26,038	+ 114	8·72	..
Liverpool	„ 11	22,380	+1,476	10	108,045	+ 3,708	116	6·5
‡L.C.C.	„ 8	83,958	+4,341	..	2,039,881	+203,335	136·7	5·25
London United	„ 18	10,574	— 100	..	57,889	— 343	..	..
Lowestoft	„ 18	161	+ 16	24	3,788	+ 185	..	..
Manchester	„ 18	30,072	+ 613	50	774,285	+25,050	183	..
Newcastle	„ 18	7,991	+ 520	..	199,130	+ 3,168	14·5	..
Newport	„ 11	1,321	+ 69	50	33,397	+ 1,254	14·5	..
Oldham	„ 19	3,602	+ 342	51	93,961	+ 3,024	23·5	·5
Pontypridd	..	..	..	..	..	..	..	..
Portsmouth	„ 11	3,229	— 328	49	98,394	— 1,500	15·25	..
Preston	„ 15	1,365	+ 54	50	36,292	— 75	..	..
Rotherham	..	..	..	..	..	..	..	..
†Salford	„ 13	4,184	— 9	49½	230,507	+ 5,977	..	..
Sheffield	„ 21	12,081	+ 502	..	311,149	+19,624	40	·25
Southampton	„ 15	1,969	+ 56	50	54,292	+ 1,523	..	..
Southend-on-Sea	„ 15	782	— 23	50	27,859	+ 2,739	..	..
South Shields	„ 18	1,045	+ 46	50½	28,044	+ 154	..	..
Swindon	„ 15	258	— 14	..	7,085	+ 285	..	..
Tyneside	„ 15	502	+ 49	11	4,093	+ 308	..	..
Wallasey	„ 18	1,866	+ 224	51½	48,028	+ 2,771	..	..
Walthamstow	„ 20	1,235	+ 23	50	34,791	+ 2,266	9	..
West Ham	„ 9	4,987	+ 207	49	121,891	+ 6,205	15·25	..
Wolverhampton	„ 15	1,772	+ 69	50	46,929	+ 4,346	14·25	..
Cen. London Rly.	„ 18	10,764	— 715	11	59,378	— 9,268	6·32	..
City & S. Lon. Rly.	„ 19	6,819	+ 183	11	38,129	+ 1,216	7·26	..
Dublin-Lucan Rly.	„ 17	283	— 8	11	1,157	+ 14	7	..
G.N. and City Rly.	„ 18	3,184	+ 138	11	17,485	+ 667	3·5	..
L'pool Overh'd Rly.	„ 18	2,747	+ 168	..	15,105	+ 1,032	6·8	4·3
Llandudno-Col. Bay	„ 17	273	+ 7	15½	1,868	+ 46	..	..
London Elec. Ry. Co.	„ 18	28,540	+1,810	11	156,280	+ 8,025	21·25	..
Mersey Railway	„ 18	4,089	+ 138	11	22,268	+ 565	4·5	..
Metropolitan Rly.	„ 19	33,332	+ 867	11	185,886	+ 5,023	24·5	..
Met. District Rly.	„ 18	23,866	+2,878	11	129,924	+ 9,808	24	..
Anglo-Argentine	„ 18	102,153	+12,72•	..	543,287	+71,096	..	..
§Auckland	Feb.	16,576	+1,874	..	126,574	+13,411	23·31	·6
Bombay (B.B.T.)	„ 8	5,721	+ 457	5	14,064	+ 657	..	..
Brisbane	Feb.	17,675	+1,925	8	86,835	+ 8,995	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Mar. 18	7,022	— 120	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	Feb.	2,968	..	..	6,212	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	Mar. 15	1,725	+ 406	..	7,550	+ 674	..	..
§Montevideo	Feb.	29,792	+3,967	52	112,497	+10,377	..	..
†Perth (W.A.)	Mar. 17	3,255	+ 103	..	18,109	+ 746	29	1

* Compared with the corresponding period of 1910. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Evening.

STOCK EXCHANGE markets are not unused to the end March account bringing a certain amount of trouble, and this present settlement has proved no exception to the rule. For a day or two the outlook was anything but pleasant, but, fortunately, the financial wind changed, and recovery became general, a substantial rise in Consols and an all-round rally in Mexican issues leading to a more happy sentiment in most directions.

The outstanding feature of the House is the amount of attention which is being directed to the stocks of the electrical railway companies. Metropolitan Consolidated, in particular, has been a buoyant market, in consequence of the company's go-ahead policy in the matter of increasing and quickening its service. There was a rumour current last week to the effect that the Tube and Omnibus Companies contemplated a scheme for raising fares, but denials of any negotiations to this end were published by the District and its immediate allies. Central Londons have advanced appreciably, so that those who bought on the suggestions recently made here as to the attractions of the stocks, can already take quite a fair profit.

With so many people asking how prices of these stocks compare with those of last year, it may be of service to reproduce the movements in the leading stocks over a short period :—

Stock.	Price. Dec. 31, 1910.	Price. Mar. 21, 1911.	Rise or fall.	1910. Highest.	1910. Lowest.
Central London Ordinary	64½	70	+ 5½	73	63⅛
Do. Def.	45	54	+ 9	54½	44
Do. Pref.	86	86	—	88	84
City and S. London Ordinary	28	35½	+ 7½	36⅝	26⅛
Gt. Northern and City Pref. "A"	⅞	⅞	—	1⅛	1⅛
Metropolitan	41½	53	+ 11½	45½	37⅜
Met. District	27½	30	+ 2½	27½	17⅝
Do. do. 4½ per cent. Pf.	86	89	+ 3	87	49
London Electric 4 per cent. Pf.	84	82	— 2	86	83
Under. Elec. Rly. 5 per cent. P.L.	101½	102½	+ 1	103⅜	100
Do. 4½ per cent.	96	98	+ 2	96	86⅞
Do. 6 per cent. income	39	54	+ 15	41⅜	32⅝

Current quotations are in several cases *ex* dividend since the end of last year, so that the actual rises are in these instances greater than appears from the above table of comparisons.

Even Great Northern & City Preferred "A" Ordinary shares have been inquired for quietly, and changed hands at 18s. 9d. The company, of course, is in a semi-waterlogged condition, and outside sources have made up the amounts necessary to meet the Debenture interest of recent years, but, with the market in hopeful mood, these £10 fully paid shares at so huge a discount are apparently tempting speculators, who are content to run big risks in a case where big profits might possibly be made, and by comparatively small outlay. But, of course, it is a sheer gamble.

The trouble in Mexico is said to be over, or nearly so, and prices are beginning to recover from the lowest points reached. Of course, a good deal of nervousness remains, and it can hardly be supposed that the revolutionary movement will blow over in a night, but the worst is known, according to this report, and the stocks of Mexican Railway companies have recovered sharply. It has been noticeable that even in the height of the little crisis, the best-class bonds of the Latin-Canadian group remained steadily in request, and manifestly the investor has not taken the highly-coloured newspaper reports with too much seriousness, although he has recognised the scope that exists in these tropical countries for accidents, human as well as Natural.

Electricity Supply shares have been very quiet, with a firm tendency. Prices show no material changes on the week. Chelseas are ⅛ lower, but City Ordinary gained ⅛. Business in the market is dwindling again, although with the increased demand which seems to be springing up for investment issues, the electricity supply group is sure to benefit.

Telegraph securities are good, and most of the active varieties have secured small improvements. Anglo-American Deferred is easier, but rises are marked in Eastern Extensions, Direct United States and Cuba Telegraphs. National Telephone stocks show a couple of small advances, but United River Plates lost their rise of the previous week.

Callenders are stronger at 9½, and Babcocks recovered after their setback. Navy estimates have made armament, iron and steel shares all better. Other manufacturing descriptions continue very firm, and the rubber share market, after being lumpish and weak, shows signs of returning resiliency.

Correction.—With reference to the statement appearing toward the end of our "Stocks and Shares Letter" in the ELEC. REV. for February 17th, we are asked to say that the statement that the Amazon Telegraph Company "is about to be amalgamated with some other" is quite without foundation.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1907.	1908.	1909.	1910.	Closing Quotations March 14th.	Closing Quotations March 21st.	Business done week ended March 21st, 1911. Highest	Lowest.	Rise + or Fall —	Present Yield per cent
		*										£ s. d.
300,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	6 — 6½	6 — 6½	6¼	..	..	Nil.
$263,244,000	Do. 5 % Deb. Red. Iss. at 98 % script all paid	Stock	5 %	5 %	5 %	5 %	96¼ — 98½	96½ — 98⅝	..	..	..	5 1 6
$255,196,000	American Telephone & Telegraph, Cap Stock ..	$100	8 %	8 %	8 %	..	147 —149	150 —152	151½	..	+2	5 5 3
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	93 — 95	93 — 95	..	..	..	4 4 3
545,920	Anglo-American Telegraph	Stock	3½%	£3 4s.	3½%	3½%	68¾— 70½	68½— 70½	68½	..	..	5 6 5
3,227,040	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	111¼—112½	111¼—112½	112¼	111¼	..	5 6 8
3,227,040	Do. do. do. Deferred	Stock	1 %	8/-	25/-	30/-	27¼— 27⅝	27 — 27½	27⅞	27	..	5 9 1
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	100 —102 xd	100 —102	101½	..	..	4 18 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	7½— 7¾	7½— 7⅞	..	..	..	5 9 5
2,462,309	Commercial Cable, Stlng. 500 year 4% Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	86½— 88½	86½— 88½	88	87½	..	4 10 5
16,000	Cuba Telegraph	10	6 %	6 %	6 %	..	9 — 9¼	9½ — 10½	10	9½	+ ½	5 9 1
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	..	17 — 18	17½ — 18½	17½	..	+ ½	5 9 7
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4%	3½— 4	3½— 4	..	..	..	5 0 6
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10%	8½— 9	8½— 9	8⅛	..	..	5 11 1
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
60,710	Direct United States Cable	10	4½%	4½%	4 %	5 %	7½— 7¾	7½— 8	7⅛	7⅛	..	6 9 0
32,500	Direct W. India Cable, 4½% Reg. Deb., 1 to 1,300, R.	100	4½%	4½%	4½%	4½%	99½—101½	99½—101½	..	..	..	4 8 8
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	135 —138	135 —138	136¾	135½	..	5 2 2
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	83½— 85½	83½— 85½	85	84	..	4 1 10
1,896,706	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	4 %	101½—103½	100⅝—102⅝	103⅛	101½	— ⅝	3 17 10
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	..	13½— 13⅝	13½— 13⅝	13⅝	13½	+ ⅛	5 1 10
752,400	Do. 4 % Deb. Stock..	Stock	4 %	4 %	4 %	4 %	99½—101½	99½—101½	100⅜	99¼	..	3 18 10
200,000	East. & S. Afric. Tel., 4 % Mt. Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100½—102½	100½—102½	..	..	..	3 18 1
181,127	Globe Telegraph and Trust	10	5½%	5⅝%	5½%	..	10⅝— 11	10⅝— 11	10⅞	10⅝	..	5 4 4
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	..	12¼— 13⅛	13 — 13½	..	..	..	4 9 9
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	20 %	18 %	18 %	..	32 — 33	32 — 33	..	..	..	5 8 0
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	..	58 — 60	58 — 60	58½	..	..	5 8 4
$41,380,400	Mackay Companies Common	$100	4 %	4 %	4½%	5 %	93 — 96 xd	93 — 96	..	..	..	5 4 2
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	76 — 78 xd	76 — 78	16/10½	16/9	..	5 2 7
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	⅞— 1	⅞— 1	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	..	1⅛— 1⅛	1⅛— 1⅛	..	..	..	5 17 1
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	1⅛— 1⅛	1⅛— 1⅛	..	..	..	5 11 1
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	104 —105	104 —105	104⅛	104¼	..	5 14 3
3,725,000	Do. do. Def. Stock	100	6 %	6 %	6 %	6 %	137½—139½	138 —140	139½	136	..	4 6 0
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	..	..	..	5 11 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10½— 11	10½— 11	..	..	..	5 9 1
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅝— 6⅛	5⅝— 6⅛	6⅛	5⅞	..	4 1 8
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98⅜—100⅜	99 —101	99½	98¼	+ ½	3 9 4
7,983,593	Do. do. 4 % Deb. Stock Red... ..	100	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	3 19 8
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid..	1	8 %	8 %	8 %	..	1⅝— 1⅞	1⅝— 1⅞	..	..	..	4 11 5
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	..	1⅜— 1⅝	1⅜— 1⅝	25/7½	..	..	4 7 3
195,955	Do. do. do. 4 % Red. Deb. Stock..	100	4 %	4 %	4 %	4 %	87 — 89	87 — 89	..	..	..	4 9 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	98½—100½	98¼—100¼	..	..	..	3 19 7
11,839	Reuter's	8	5 %	5 %	5 %	..	7½— 8	7½— 8	..	..	..	5 0 0
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	96½— 98½	96¼— 98¼	..	..	..	4 11 5
2,992	Submarine Cables Trust..	Cert.	6 %	6 %	6 %	..	133 —136	133 —136	..	..	..	4 8 3
150,000	United River Plate Telephone	5	8 %	8 %	8 %	..	7⅛— 7⅜	7⅛— 7⅜	7⅜	7⅛	+ 1/16	5 8 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅛— 5⅜	5⅛— 5⅜	..	..	..	4 7 11
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	2½%	2½%	2½%	..	1⅜— 1½	1⅜— 1½	..	..	..	4 3 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	98 —100	98 — 100	..	..	..	4 0 0
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930 ..	10	7 %	7 %	7 %	6 %	13½— 14	13¼— 14	13⅞	13⅜	..	4 5 9
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	100 —102	100 —102	101⅛	101	..	3 18 5
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	2⅝— 2⅞	2⅝— 2⅞	56/3	52/6	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10 — 10½	10 — 10½	10⅜	..	..	5 14 3
4,669	Do. do. 6 % Cum. 2nd Pref.	10	£2 6	15 %	14½%	..	9 — 9½	9 — 9½	..	..	..	6 6 4
80,000	Do. do. 5 % Debs., Nos. 1 to 800 ..	100	5 %	5 %	5 %	5 %	101½—103½	101½—103½	..	..	..	4 16 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5% Cum. 1st Pref. 1 to 640,000	5	..	..	5 %	..	4⅞ — 5⅛	4⅞— 5⅛	5⅛	99/4½	..	4 17 7
500,000	Do. 5 % 2nd Pref., 800,000 to 1,300,000	5	..	..	5 %	..	4⅜ — 4⅞	4⅜— 4⅞	95/7½	99/9	..	5 2 7
4,465,674	Do. 4 % Deb. Stock	Stock	..	4 %	4 %	4 %	92 — 93½	92 — 93½	92⅝	92	..	4 5 7
329,002	Auckland E. Trams, 5 % 1st Mort Deb. Stock ..	100	5 %	5 %	5 %	5 %	104½—106½	104½—106½	..	..	..	4 13 11
830,000	Babcock & Wilcox, 1 to 830,000	1	20 %	20 %	24 %	..	5⅛— 5⅛	5⅜— 5⅝	5⅜	5⅛	..	4 4 9
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	..	1⅜— 1½	1⅜— 1½	..	..	..	4 0 0
600,000	British Columbia E. Rail Def. Ord. Stock	100	8 %	8 %	8 %	..	145½—148½	145 —148	147⅛	148	— ½	5 8 1
600,000	Do. Pref. Ord. Stock	100	5 %	6 %	6 %	..	125 —128	125 —128	126⅜	125	..	4 10 1
600,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	..	109 —112	108 —111	109½	108½	—1	4 5 9
230,800	Do. 4½ % 1st Mort. Deb., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —105	104⅜	..	+ ½	4 6 7
210,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
133,301	British Electric Traction	10	Nil	Nil	Nil	..	1⅞ — 2⅛	1⅞— 2⅛	38/9	37/-	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	8 %	12½%	Nil	..	4⅛— 5⅛	4⅛— 5⅛	100/-	96/3	..	Nil
1,473,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	95 — 99	95 — 99	..	..	..	5 1 0
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	75 — 80	75 — 80	75½	..	..	5 9 9
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	10 %	7 — 7½	7 — 7½	..	..	..	6 13 4
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5⅞— 6⅛	5⅞— 6⅛	6⅛	5⅛	..	4 16 0
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
201,579	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
500,000	British Westinghouse 10 % Pref., 1 to 200,000 and 275,001 to 575,000 Non-cum.	5	Nil	Nil	Nil	..	⅜— ⅝	⅜ — ⅝	8/-	..	..	Nil
1,241,353	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	59 — 62	59 — 62	..	..	..	6 9 1
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	9/16— 11/16	9/16— 11/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,838	Brush Electrical Engineering, Ord., 1 to 140,838 ..	2	Nil	Nil	Nil	..	1/16— 3/16	1/16— 3/16	..	..	..	Nil
199,835	Do. do. Non-cum. 7 % Pref..	2	Nil	Nil	Nil	..	⅛— ⅜	⅛— ⅜	..	..	..	Nil
125,000	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	56 — 61	56 — 61	..	..	..	7 7 7
125,000	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	38 — 43	38 — 43	..	..	..	10 9 4
137,610	Calcutta Trams, 1 to 137,610	5	6 %	4½%	4½%	..	5⅜— 5⅞	5⅜— 5⅞	5⅝	5⅜	..	8 16 7
47,295	Do. 5 % Cum. Pref., 1 to 47,295 ..	5	5 %	5 %	5 %	..	4⅛— 5⅛	4⅛— 5⅛	5⅛	..	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 — 100	..	..	..	4 10 0
35,000	Callender's Cable Construction shares	5	15 %	15 %	10 %	..	9⅛— 9⅜	9⅛— 9⅜	..	..	+ ⅛	5 2 7
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	4⅛— 5⅛	4⅛— 5⅛	5⅜	5⅛	+ ⅛	4 17 1
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	..	7/16— 9/16	7/16— 9/16	10/9	9/6	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	12 %	12½%	17½%	..	3⅛— 3⅞	3⅛— 3⅞	63/9	63/-	— ⅛	5 7 8
205,369	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4 %	4½%	4½%	103 —106	103 —106	103½	..	..	4 4 11
1,854,720	Central London Railway, Ord. Stock	Stock	3 %	3½%	3 %	3 %	66 — 68	69 — 71	70	68½	+⅜	4 4 6
572,640	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 — 86	85 — 87	..	..	+1	4 12 0
572,640	Do. do. Def. do.	Stock	2 %	2½%	2 %	2 %	48 — 50	53 — 55	55	48½	+5	3 12 9
1,480,000	City and South London Railway	Stock	2½%	1½%	1½%	1½%	29½— 30½	35 — 36	35½	30½	+5½	4 8 4
85,000	Crompton & Co., Nos. 1 to 85,000	8	5 %	Nil	Nil	..	⅜— ½	⅜— ½	..	..	..	Nil
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 1,100 of £50 Red	..	5 %	5 %	5 %	5 %	70 — 80	70 — 80	..	..	..	6 0 5

* Unless otherwise stated, all shares are fully paid.

‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations March 14th.	Closing Quotations March 21st.	Business done week ended Mar. 21st, 1911.		Rise + or Fall —	Present Yield per cent.
		*	1907.	1908.	1909.	1910.			Highest	Lowest		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	6 %	5 %	..	7/6 — 1	7/6 — 1	..	..	..	5 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	..	1 — 1⅛	1 — 1⅛	..	..	..	5 6 8
265,430	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12½ — 13½	12½ — 13½	..	..	..	4 10 7
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	2½%	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	12/9	11/3	..	Nil
17,189	Do. "A" shares, 01—017,189	5	2½%	Nil	Nil	..	1⅛ — 2⅜	1⅛ — 2⅜	..	..	..	Nil
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	66 — 70	67 — 71	..	..	+1	5 12 8
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	80 — 83	80 — 83	82	80½	..	6 0 6
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	..	¾ — 1	¾ — 1	..	..	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	..	1 1/16 — 2 1/16	1⅛ — 2	..	..	— 1/16	7 0 0
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	8 — 8½	8 — 8½	..	..	..	5 17 8
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	85 — 90	85 — 90	..	..	..	4 8 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	½%	Nil	Nil	..	¾ — 1	¾ — 1	..	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼ — 10⅜	10¼ — 10⅜	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103¾	102 —103¾	..	..	..	4 16 10
40,000	Henley's (W.T.), Telegraph Works, Ord.	5	15 %	15 %	15 %	15 %	12⅜ — 13½	12⅜ — 13½	13	12⅜	— ⅛	5 13 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	4⅜ — 5⅛	4⅜ — 5⅛	5⅛	96/3	— 1/16	4 7 10
150,000	Do. do. 4½ % Mort. Deb Stock	Stock	4½%	4½%	4½%	4½%	107 —109	107 —109	..	..	..	4 5 9
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10 %	10 %	10 %	..	16 — 16⅜	16 — 16⅜	..	..	..	5 19 5
37,500	†Liverpool Overhead Railway, Ord.	10	½%	Nil	Nil	1½%	2 7/16 — 2 1/8	2⅛ — 2⅜	..	..	+7	5 9 1
10,000	† Do, do. Pref., fully paid	10	5 %	5 %	5 %	5 %	7⅜ — 7⅝	8⅛ — 8⅜	..	..	+1 1/16	5 15 11
600,070	London United Trams. (1901) 1 to 50,007	10	3 %	Nil	Nil	Nil	1½ — 2⅜	1½ — 2⅜	..	..	..	Nil
899,930	Do. do. 60,008 to 100,000	10	3 %	Nil	Nil	Nil	1½ — 2⅜	1½ — 2⅜	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	3⅜%	Nil	Nil	2⅜ — 3⅛	2⅜ — 3⅛	58/9	56/10½	..	..
1,649,930	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	73 — 77	73 — 77	73	..	..	5 3 11
5,732,062	Metropolitan Consolidated	100	½%	½%	1 %	1½%	45⅜ — 46½	52⅜ — 53½	53½	45⅞	+7	2 2 3
2,640,914	Do. Surplus Lands	100	2⅜%	2⅜%	2⅜%	2⅜%	66 — 68	66 — 68	68	66½	..	4 0 11
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	26½ — 27	29⅜ — 30½	30⅛	26⅞	+2⅜	Nil
391,397	Metropolitan Electric Trams., Ord.	1	..	4½%	5%	5⅝%	1/16 — 1 1/16	1/16 — 1 1/16	19/9	19/6	..	4 14 1
314,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	3/32 — 3/16	3/32 — 3/16	3/-	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	13/16 — 7/8	13/16 — 7/8	17/9	17/3	..	5 9 7
589,183	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	6 %	..	125½ —126½	125 —126	126½	125½	— ½	4 15 3
$9,000,000	Do. 1st Mort. 50-year 5 % Gld. Bds.	..	..	5 %	5 %	..	95 — 96	95 — 96	96	94½	..	5 4 2
245,000	Potteries Electric Traction	1	4 %	Nil	2 %	..	3/32 — 1/8	3/32 — 1/8	6/6	..	..	4 6 7
245,000	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	5/32 — 3/16	5/32 — 3/16	13/3	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	81 — 84	81 — 84	..	..	..	5 7 2
37,350	Telegraph Construction and Maintenance	12	17½%	15 %	17½%	20 %	37 — 39	36½ — 38½	37	36½	— ½	5 19 5
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1919	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 5 0
1,000,000	Underground Electric Railway, 5 % Prior Lien	..	..	5 %	5 %	..	102 —103	102 —103	102½	..	..	4 17 1
2,818,700	Do. do. 4½ % Bonds	..	..	4½%	4½%	..	97 — 99	97 — 99	98⅜	97⅜	..	4 10 11
4,928,050	Do. do. 6 % Income Bonds	..	..	..	..	1 %	47 — 48	53 — 55	54⅜	48⅜	+6½	1 16 4
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	10 %	5 %	Nil	..	⅜ — ⅝	⅜ — ⅝	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	6 %	6 %	3 %	..	1 — 1½	1 — 1½	..	..	..	12 0 0
215,769	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	55 — 65	55 — 65	..	..	..	6 3 1

ELECTRICITY SUPPLY COMPANIES.

80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 80,449	5	10 %	10 %	10 %	10 %	7⅞ — 7⅞	7⅞ — 7⅞	7⅞	..	..	6 7 0
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7⅞ — 7⅞	7⅞ — 7⅞	7⅞	..	..	4 18 11
402,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 —103	99 —103	..	..	..	3 17 8
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	4 — 4¼	4 — 4¼	84/4½	83/9	..	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4¼ — 4⅜	4¼ — 4⅜	88/9	88/1½	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	95 — 97	95 — 97	97	96⅛	..	4 2 6
49,436	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	5 %	4⅛ — 4⅜	4 — 4½	84/6	82/6	— ⅛	5 11 1
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	99 —101	100 —102	..	..	+1	4 8 3
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	7 %	7 %	11⅝ — 12⅜	12 — 12½	12⅝	12⅛	+ ⅛	5 12 0
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12 — 13	12 — 13	12½	..	..	4 12 4
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	119 —123	119 —123	121	119	..	4 1 4
300,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	2 %	Nil	Nil	..	1⅜ — 2	1⅜ — 2	..	..	..	Nil
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	..	2⅝ — 3⅛	2⅝ — 3⅛	..	..	..	7 16 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	5 %	5 %	5 %	92 — 94	92 — 94	..	..	..	5 6 5
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅞ — 8⅛	7⅞ — 8⅛	8⅛	7⅞	..	5 19 5
55,000	Do. do. 6 % Pref., 40,001—80,000 and 120,001—135,000	10	6 %	6 %	6 %	6 %	10⅜ — 11⅜	10⅞ — 11⅛	11⅛	11 1/16	..	5 5 6
450,000†	Do. do. 4½ % Deb. Stock	Stock	4½%	4½%	4½%	4½%	107⅛—110½	108½ —111½	110½	110	+1	4 0 9
450,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	101	100½	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares.	5	Nil	Nil	Nil	..	⅛ — ¼	⅛ — ¼	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	Nil	Nil	Nil	..	2⅛ — 2⅜	2⅛ — 2¼	47/6	..	+ ⅛	Nil
490,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	82 — 85	83 — 86	84½	84	+1	5 4 8
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	5 %	5 %	..	81 — 83	81 — 83	83	..	..	5 17 0
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	..	4½ — 4⅝	4½ — 4⅝	90/-	..	..	5 15 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	..	4⅞ — 5⅛	4⅞ — 5⅛	..	..	..	4 11 11
94,350	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	8½%	8½%	8½%	9 %	6⅞ — 7⅛	6⅞ — 7⅛	7	6⅔	..	5 19 4
$1,526,500	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	5 %	5 %	..	102 —104	102 —104	..	..	..	4 16 2
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	8 %	8 %	9 %	7 — 7⅜ xd	7 — 7⅜	..	..	..	5 16 2
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	93 — 95	93 — 95	..	..	..	4 4 3
111,000	London Electric Supply Corporation, Limited, Ord.	3	2½%	3 %	2 %	2 %	1⅞ — 1⅞	1⅞ — 1⅞	36/3	..	..	3 3 6
90,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	6 %	4⅜ — 5⅛	4⅜ — 5⅛	98/9	97/6	..	5 17 1
887,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½%	4 %	4 %	4 %	91 — 94	91 — 94	93	92½	..	4 5 1
200,000	Metropolitan Electric Supply, 100,001 to 300,000	5	6½%	5 %	5 %	5 %	4⅛ — 4⅜	4⅛ — 4⅜	85/7½	..	..	5 8 1
76,121	Do. 4½ % Cum. Pref. 1—76,121	5	4½%	4½%	4½%	4½%	4⅛ — 4⅜	4⅛ — 4⅜	90/-	..	..	4 17 4
250,000	Do. 4½ % 1st Mort. Deben. Stock	Stock	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	84 — 87	84 — 87	..	..	..	4 0 6
$5,929,600	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	5 %	88 — 90	88 — 90	88¼	..	—1½	5 11 1
$13,585,000	Do. Light and Power Co., Ltd., Common	$100	4 %	3½%	4 %	..	88⅜ — 90½	87 — 89	89	87½	..	4 9 11
$5,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	7 %	7 %	..	108 —111	108 —111	109	108	..	6 6 2
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	5 %	5 %	5 %	93⅛ — 95⅜	93 — 95	94½	93½	— ½	5 5 3
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	97 — 99	97 — 99	..	..	..	4 10 11
130,491	Newcastle-on-Tyne, 1 to 50,000 & 57,010 to 137,500	5	8 %	2½%	4 %	4 %	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	4 6 6
137,500	Do. 5% Pref., 1 to 137,500 Non. Cum.	5	5 %	5 %	5 %	5 %	4⅛ — 5	4⅛ — 4⅜	..	..	— ⅛	5 8 1
150,000	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,500	100	..	..	5 %	..	97½ — 99½	98 — 100	..	..	+ ½	5 0 0
10,852	Notting Hill Electric Lighting	10	7½%	7 %	7½%	8 %	12 — 12¾	12 — 12¾	..	..	..	6 5 6
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	6 — 6⅛	6 — 6⅛	6⅛	6 1/16	..	5 7 8
120,000	River Plate Elcty. Co. Ord.	Stock	6 %	8 %	9 %	..	225—235	225 —235	232½	..	..	3 16 6
100,000	Do. do. 6% Non Cum. Pref.	Stock	6 %	6 %	6 %	..	103—113	103 —113	..	..	..	5 6 2
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 3
40,000	St. James' and Pall Mall Electric Light, Ord.	5	10 %	10 %	10 %	10%	8⅜ — 8⅝	8⅜ — 8⅝	8⅛	..	..	5 12 8
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6⅞ — 7⅛	6⅞ — 7⅛	..	..	..	4 16 7
150,000†	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	3½%	86 — 88	86 — 88	86½	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	Nil	1⅝ — 2	1⅝ — 2	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	4 %	5 %	5 %	5 %	3 — 3⅛	3 — 3⅛	..	..	..	5 19 5
100,000	Do. do. 5 % 1st Mort. Deb.	100	..	5 %	5 %	5 %	101 —104	101 —104	..	..	..	4 16 3
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	Nil	Nil	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 — 1⅛ xd	1 — 1⅛	..	..	..	6 11 9
240,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	97 — 99	97 — 99	..	..	..	4 10 11
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	⅜ — ½	⅜ — ½	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	1⅜ — 2⅜	1⅜ — 2⅜	..	..	..	10 10 6
271,700	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	83½ — 85½	83½ — 85½	85½	..	..	5 5 3
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000	1	..	5 %	..	..	¾ — 1	¾ — 1	19/4½	..	..	5 0 0
110,000	Westminster Electric Supply, Ord.	5	10 %	10 %	10 %	10%	7⅞ — 8⅜	7⅞ — 8⅜	7¾	7⅞	..	5 19 5
81,279	Do. do. 4½ % Cum. Pref. (Reduced from 5% since 31st Dec., 1905)	5	4½%	4½%	4½%	4½%	5 — 5⅛	5 — 5⅛	..	..	..	4 3 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 3 per cent. March 9th. 1911.

SOME REFLECTIONS ON THE NEW MINING REGULATIONS.

By W. WELLESLEY WOOD.

While the proposed new Mining Regulations present many points needing careful consideration on the part of all concerned with this work, it is proposed here only to consider how they will affect the manufacturer of mining machinery and the contractor who may have plant to install. The general principles of these Regulations are practically identical with those of the existing ones, but there is a tendency in them to go further, to specify definite ways by which ends previously considered desirable shall be attained, and to insist on the adoption of the particular official method suggested.

One of the most important points is the compulsory appointment of an electrician to look after the plant, keep a log in the prescribed official form, examine all apparatus, and test earth connections *as often as may be necessary to avoid danger*. The definite and heavy responsibility thus placed on the colliery electrician will, in many cases, necessitate the employment of a larger, and, perhaps, more highly trained staff, which cannot fail to be of advantage, for while in some mines no fault whatever can be found in this direction, in others many of the troubles experienced by the manager and contractor have been due to inadequate and unskilled attendance.

In order to enable the staff to carry out proper tests, a megger with generator which gives twice the working pressure, and a testing transformer for alternating-current systems giving twice the working pressure, are now practically a necessity to make a mining installation complete. It would, however, have been as well if the memorandum had pointed out that earth connections should always be tested with a linesman's galvanometer, or its equivalent, as cases are on record where a megger has been used for this purpose and conveyed a totally wrong impression to those using it as to the soundness of the earth wire.

Dealing with the general construction of apparatus, in cases where there is occasional danger of firing gas, &c., certain parts of the plant have to be so enclosed as to prevent "open sparking." This term "open sparking" is possibly at first sight somewhat misleading, as on studying the definition one finds that what is actually needed to comply with the Rules, is an enclosure such that, should an explosion of any kind occur within it, no flame shall issue outside. In other words, the case will have to be what has hitherto been described as "flame proof," a condition seldom actually attained.

The Rules regarding underground switchgear are so framed that to comply with them the ironclad, or so-called dust-proof type, will have to be used. While this construction lends itself well to three-phase work with oil switches, it does not form the best arrangement for continuous-current switchgear of large capacity where considerable clearance must be allowed to prevent danger of arcing to the enclosing covers. In this respect, therefore, the Rules will to a certain extent handicap continuous-current plant, and possibly lead to the use of oil switches for controlling it. According to a paper recently read before the South Wales Institute of Engineers by Mr. Collis, an oil switch does not cause any undue rise of pressure on rupturing a continuous-current circuit, as has often been supposed, and the only objection to its use is the greater carbonisation of oil which is bound to take place, on which point at present there are not very many data available. More attention will probably have to be paid to the design of switchgear and motor terminal cases in the way of providing reliable devices for clamping the cable armouring and making earth connectons, but one of the difficulties in connection with this is that so very frequently the size of cable to be employed is not known to the manufacturer when the plant is supplied.

It is now necessary so to arrange that in the event of a fault or leakage, current is cut off from the part affected. The Memorandum points out that this can be obtained by earthing the neutral in such a way that sufficient current would flow with an earth on one phase to operate either the overload circuit-breaker or fuses, or by the use of those leakage trips which have recently been given considerable prominence. No note is made among the definitions of what is meant by the word "leakage," but the deduction from reading the Memorandum is that it is something in the nature of a dead earth, as, of course, otherwise fuses or overload circuit-breakers would not produce the effect indicated. This point needs clearing up, and it would be interesting also to know whether such a safety apparatus as the Fisher gate-end box, which causes a certain definite leakage to take place, would be permitted. This gate-end box and similar apparatus have much to recommend them, and appear to be based on sound principles, as a failure of the earth connection ensures the interruption of supply. The Memorandum recommends the use of the minimum amount of automatic gear, and suggests relying on one or two trips kept in good order rather than on the fitting of such apparatus to every switch; the Rules could accordingly be complied with by a single trip on the main feeder or generator panel, arranged to cut off current if a dead earth occurs on the system. In practice, however, the interruption of the whole supply whenever a leak occurred would probably be found intolerable. The added protection which the leakage trip gives against shock is but slight, and if (as appears to be the case) the principal object in specifying its use is to reduce the danger of explosion (which it certainly does), then it would be better to fit it only to circuits running where there is real danger should open sparking occur; and the question arises whether the Rules will permit this limitation. The makers of the device put forward as a merit instantaneous tripping in the case of earth, and to get over the difficulty referred to above would propose to graduate the setting, trips on individual machines being lightly, and those on the main feeders heavily, set. There is no doubt, however, that if a sudden severe earth occurred all the trips in series would operate, and it would seem desirable (if such apparatus is insisted on for all circuits) to put a time lag on the main feeders, so as to give time for the instantaneous trips on branch circuits to clear the part affected.

Disregarding cost, the best arrangement would probably be to put instantaneous trips on each branch circuit of importance, a trip with time lag on each main feeder, and to earth the neutral through a high resistance which would only pass a maximum predetermined current. This current, in addition to being capable of causing any trip to operate on a dead earth, must also be large enough to supply all the trips on any main feeders which may be in parallel, as otherwise simultaneous faults on two feeders might leave both trips unaffected.

Some engineers have a prejudice against earthing the neutral, and the Rules would at first appear to leave the option of either insulating or earthing, as may be preferred; in fact, the Memorandum devotes some space to specifying the requirements on a system with insulated neutral. The question arises, however, how the above requirements can possibly be met on such a system; and, unfortunately, the Memorandum passes over this point somewhat vaguely. Possibly the correct interpretation is that on an insulated system it is not considered that leakage takes place with an earth on one phase or pole only.

The great importance of the earthing of motor or switch cases, armouring of cables, &c., has long been recognised, and the new Rules now specify the size and type of earth connection to be used, and state that all earth wires, cable armouring, &c., must be connected to an earthing system at the surface of the mine, to which point, should it be decided to earth the neutral of a three-phase system or the mid-volt point of a D.C. system, this connection must also be made. Considering a frequent case in practice where power is transmitted through an overhead line for some distance on the surface, and then taken by armoured cable down the shaft, it will apparently be necessary to run an additional conductor of the same section as the power conductors along the transmission line, so as to couple the armouring of the cable to the earthing system of the generating plant. This is a point worthy of note by any of those firms who secure orders for installations "to be complete and in every way in accordance with the proposed New Mining Regulations."

The same remarks apparently apply to the case where power

is taken from a supply company, and an earthing wire must be run from the nearest generating or transforming point. The question as to whether this will be insisted on is one on which a definite decision is desirable, as the rule is at present somewhat ambiguous.

Another very important consideration from the commercial point of view is the compulsory use of cables so arranged that all the conductors of one circuit shall be contained in one enclosing cover, lead sheath or double wire armouring, the only exception being cables for portable machinery and for circuits under 250 volts D.C. and 125 volts alternating. There is no doubt that as long as the continuity of the enclosing metallic covering is maintained, this class of cable gives a greater protection against shock and open sparking than any other, and it has long been considered good practice to install this cable for H.T. feeders which are generally not carried very far inbye, and consequently receive more attention than the L.T. branch circuits. The objection to their use in some cases has been the danger of the interruption of this sheath, either through corrosion, accident, or other causes, when an added danger arises owing to the possibility of a long length of conductor sheath or armouring, normally dead, becoming alive; there are also many places where cables are out of reach and not liable to damage, in which case armouring is superfluous. These facts, combined with the very much greater cost of armoured cables, have led to the general practice of installing unarmoured cables for three-phase medium pressure and for continuous-current work (except, of course, in the shaft and places where there is considerable risk of mechanical damage), and no doubt in certain cases they have been used in positions where armoured cables really ought to have been installed.

The practical objections to the use of armoured cables have been met by decreeing that cables must be protected against damage and corrosion where necessary, and tested as often as required to prevent danger, but it is to be feared that by now insisting on the use of these cables in all cases, the application of electricity will, to a certain extent, be needlessly hampered. This is particularly the case with regard to the adoption of auxiliary haulages and similar machines (for which the Eight Hours' Act was beginning to create a demand) where the power required is small, and the cost of cables to comply with the Rules, may be as much as $2\frac{1}{8}$ times the cost of those now generally in use.

A further difficulty will be in the handling of large two-core D.C. armoured cables. Hitherto, in three-phase work where large power has been required, it has been generally possible to use high pressure, and so keep down the cable sizes, but there are many mines equipped with D.C. plant of large power where the single-core cables are as large as the largest three-core cables in use. In future the size will be more than doubled, and here again, although for some purposes there is no doubt continuous current is the more suitable, it will to a certain extent be handicapped.

Finally, it may be said that the proposed new Rules in practically all cases call for a system which may be considered the ideal one to meet the worst conditions, and it is to be hoped that the increased confidence in electricity, which should thereby be created, will off-set the increased expenditure which will have to be incurred in its use.

The Switchman.—A Eulogy.

Proud and magnificent! Great and omnipotent!
Over the switchboard in glory he struts.
Bend down and bow to him! Kneel and kow-tow to him!
Lo! He's the switchman, and "one of the knuts."
Cream of gentility! Sprig of nobility!
Plebeian logkeepers, down on your knees!
Haughty aristocrat! Marquis of Rheostat!
Quake at his voice and obey his decrees!

Notice the style of him! Languorous smile of him!
Weigh up the manner his togs he will doff!
Little to say to us! Different clay to us!
Each one can see he's a blue-blooded toff!
Send him victorious; happy and glorious!
Greater by far than the Rajah of Bhong!
Wise as Diogenes! Greater than Socrates!
Glorious Super-man! May he live long!

William Tranter.

PROCEEDINGS OF INSTITUTIONS.

The Laying and Maintenance of Transmission Cables.

By C. Vernier, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *London, March 9th*, 1911.)

While America and the Continent can show longer transmissions than we have in this country, we are in no way behind in regard to underground work, and in our Northern counties we can point to what is undoubtedly the most extensive system of underground E.H.T. cables in the world.

The three-phase alternating-current system has been almost universally adopted for use in all transmission schemes during the past 10 years. The cables will, therefore, be invariably three-core paper-insulated and lead-sheathed, usually operated at pressures between 6,000 and 20,000 volts. Cables supplied by leading cable-manufacturing firms are of a very high degree of excellence, and it is exceedingly rare for breakdowns to occur as the result of faulty manufacture.

The draw-in system has many advantages in congested districts where there is a likelihood of extensions being required along the same route, but generally it is too expensive for any extended use. Draw-in systems usually consist of separate earthenware pipes or multiple-way ducts laid in concrete, with man-holes spaced at suitable intervals according to the largest size of cable likely to be drawn in. Bitumen fibre conduits, which are much used in America, have more recently been used in this country, and appear to provide an excellent system.

Single pipes provide greater safety than multiple-way ducts in the event of a short-circuit taking place in the ducts. Single pipes also lend themselves much more freely to deviation singly round obstructions, without it being necessary to deviate the whole line of pipes. For these reasons, multiple-way ducts are seldom used for heavy transmission work.

The design of manholes often leaves much to be desired. It is of first importance that the cables should be so protected in the manholes that a breakdown on one cable cannot affect the other cables. Unsupported bends in the cables should be avoided. Fig. 1 shows

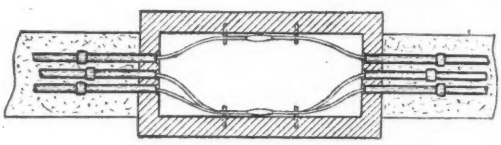


Fig. 1.

a common type of manhole, where the cables have to be bent out of the pipes to the side walls. Accidents have occurred from manhole covers being dropped on to such cables. A much neater and safer arrangement is illustrated in fig. 2, in which the pipes are gradually splayed out as they approach the manholes.

As far as possible, the pipe line should not exceed two pipes in width, on account of the awkward bend from the middle pipe. Cast-iron pipes are preferable to earthenware ducts, as they can be made watertight, and if bonded, protect the cables from electrolysis. E.H.T. cables drawn into earthenware ducts should be wire

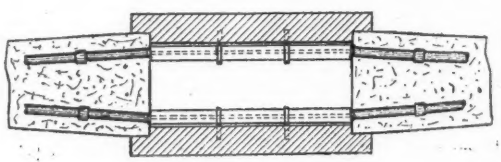


Fig. 2.

armoured; at the least, they should be taped and braided over the lead. All cable armourings and lead sheaths should be bonded, and earthed at each manhole. The facility for repairs claimed for the draw-in system is of doubtful advantage, as a whole length of cable between manholes has to be substituted for the faulty portion.

Earthenware troughs are better for the solid system than wood; if the latter is used, it should be creosoted under pressure. Coal-tar creosote has no action on lead or iron, but wood creosote is objectionable. Wood troughing should be made as in fig. 4, not fig. 3, and jointed as in figs. 5 and 6. Earthenware troughings should be glazed outside but not inside, as pitch or bitumen does not adhere to glaze. Cast-iron troughing is expensive, but makes a sound job if the lengths are properly bonded; the lead sheath and armouring should be bonded to the trough. Asphalt-lined sheet steel troughs are also used; in this case the cable sheaths are insulated by the asphalt, and no bridges are required. Trinidad bitumen, though $2\frac{1}{2}$ to 3 times as costly as pitch, is much superior to the latter; pitch softened with oil is of doubtful reliability, and alone it is too brittle. The bridges are the weakest part of the solid system. They should never be made of wood, which absorbs moisture and decays, attacking the lead. Earthenware, china, or asphalt, should be used. Bushes at trough

and pipe ends should be of glazed earthenware, and all organic materials, such as canvas, waste, &c., should be kept clear of the lead. Some kinds of cement act upon lead. Asphalt bridges are strong enough for small cables, but glazed earthenware is best for

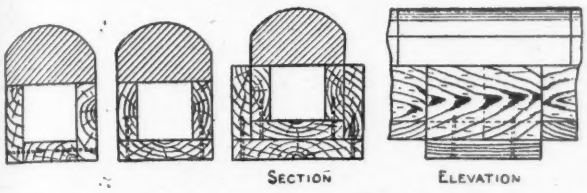


Fig. 3. Fig. 4. Fig. 5.

heavy cables; the bridges should be dipped, when quite dry, in a fluid mixture of pitch and oil, so that the filling composition will adhere to them. The bridges should make point contact with the

Fig. 6. Fig. 7. Fig. 8.

troughs (figs. 7 and 8), so that the filling composition can surround them entirely. Cables with a braided covering are preferable for laying on the solid system, as the composition adheres to the braiding; and armoured and jute-served cables laid in bitumen, make the very best solid system. Dome-shaped tiles 3-in. thick are better than cast-iron covers, as they turn the point of a pick; they

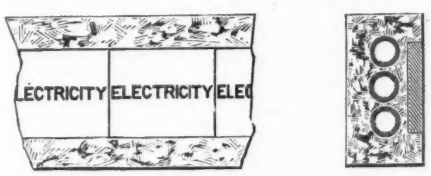


Fig. 9.

should have the owners' name, or the word "electricity," stamped on them. Conduits laid in concrete are more liable to damage than troughs. They should have indicating tiles as shown in fig. 9. After 12 years' experience of it, the author does not consider the solid system a thoroughly practical system for use on a large

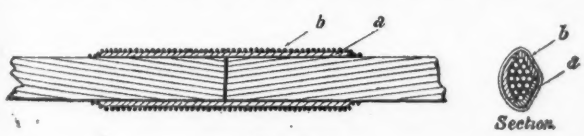


Fig. 10

scale; the difficulties in obtaining good workmanship in this uncertain climate are very great, and its rigidity is a very serious disadvantage.

Armoured cables for transmission lines should have wire armouring in preference to tape; they are usually laid direct in the ground, with tiles or 2-in. creosoted planks laid over them with about 3 in. of soil between. Planks are better than tiles, which are liable to be displaced by excavators.

Armoured cables do not offer as good a protection from chemical action in bad ground as a properly laid solid system. The popularity of the solid system in this country may be almost entirely attributed to some very rapid failures of armoured cable systems which have been experienced in the past.

It is the practice on the Continent to surround armoured cables with sand when other kinds of soil are encountered, but this method adds very seriously to the cost of the work, and it is questionable whether a layer of sand is an advantage except in very dry ground. Clay has been said to affect armoured cables injuriously, but this has not been the author's experience, and in bad soils it is better to surround the cables with well punned clay.

Attention has been directed to the improvement of the protective coverings on armoured cables, to render these coverings as good a protection to the cables as a good solid system, but with the very important advantage that the work can be carried out in the cable-makers' shops under careful supervision and without any consideration of weather.

The improved coverings adopted, and which are now provided on all armoured cables laid by the power companies operating on the North-East Coast, consist first of a layer of a flexible bitumen compound $\frac{1}{10}$ in. thick coated directly on to the lead and served over all with two specially closely woven bitumen impregnated tapes. The cable is then served over these tapes with compounded jute yarn to form a bed for the armour, after which the armouring, either of steel tapes or wires previously passed through a bath of

Fig. 11.

waterproof composition, is put on. This armouring is then served with jute yarn, passed through a bath of hot compound, and finally lime washed.

The total cost of the specially protected armoured cables when laid is very little more than the cost of plain lead-covered cables

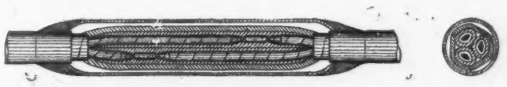


Fig. 12.

laid on the solid system, and with this slight extra expense a much more suitable system is obtained.

The satisfactory jointing of cables is the most important operation in connection with cable laying; badly designed, and especially badly-made joints, will prove a constant source of trouble. Joint break-downs are inexcusable at the present day; only thoroughly skilled men with a long period of training should be employed on important work like transmission cables.

The jointing of the conductors is usually carried out by inserting the ends into a short copper tube, the joint being afterwards soldered. This form of joint is often very inferior; it is seldom that the tubes fit the conductors, and any sort of a fit is often considered good enough, as the joint will afterwards be soldered. In transmission work, however, the cables are capable of considerable overloading, and can safely be run continuously up to a temperature

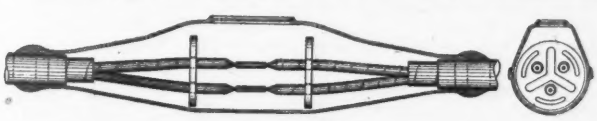


Fig. 13.

of about 150° F. Overloading and unloading of the cables throws a great strain on the joints, owing to the expansion and contraction of the conductors due to changes of load, and joints with poor contacts heat up and frequently pull out. The copper tubes or ferrules are sometimes split in halves, bound together at each end, so as to tighten on the conductors, or again split on one side only to allow of being closed up to fit. As the shape of conductor used in three-core cables is seldom round, but approximately triangular in what is known as the "clover leaf" cable, round tubes can scarcely be expected to make a satisfactory joint, except possibly with very small cables, which can be pinched to a circular shape. Because of this, many engineers specify that the conductor cores must be telescoped together. This form of joint, unfortunately, while a very great improvement from the point of view of electrical contact, is mechanically about the weakest joint which it is possible to use.

The author recently devised a new method of jointing which overcomes these disadvantages, and which, in its construction, is so simple as to ensure sound joints without the exercise of any great skill.

The method of jointing, which is illustrated in fig. 10, consists in using strips of flexible copper braid (*a*) which are laid longitudinally along the conductors, and are bound down on them tightly by a circular binding of copper wire (*b*), the joint being afterwards soldered. Joints of this type give a greatly increased electrical contact, as the flexible braid is compressed tightly into all the interstices of the conductor strand; a joint of this type, made as in fig. 10 and left unsoldered, required one-third of a ton merely to pull one of the conductors out of the braids. A similar joint again unsoldered was run up gradually to 7,000 amperes per square inch, its temperature rise being at all times lower than that of the conductor.

Fig. 11 shows an alternative type of this joint for heavier conductors, which consist of more than three strands of wires. In this the continuity of each strand can be maintained independently by separate layers of copper braid. The copper braid when soldered and dissected can scarcely be distinguished from solid copper, so thoroughly does it become filled with the solder, which it holds like a sponge.

Figs. 12 and 13 show the two representative types of joints generally used for all working pressures up to 20,000 volts. Each of these types has special features. The remarks which follow refer especially to joints for 20,000 volts; at such high pressures the weaknesses of joints reveal themselves.

In fig. 12 the cores are in contact after having been separately insulated by wrapping with an insulating tape. White linen tape

boiled in resin oil just before using, is generally used. All tapes are liable to absorb moisture, and by boiling the tape in oil just at the time it is required all moisture can be extracted with certainty. Insulating tapes boiled in this manner are also saturated with oil, which is squeezed out in the process of wrapping on, and fills all crevices between layers. Factory impregnated tapes are of a drier nature, and do not possess this feature, which is extremely important, as in E.H.T. joints the breakdown pressure is enormously reduced if air is present. Joints insulated with tape and mica, notwithstanding the very great dielectric strength of the latter material, give very much lower breakdown pressures than joints insulated with tape only, the difference being due entirely to the absence of air in the latter case.

The three cores, after being separately insulated, are taped over together by another wrapping of insulating tape over their whole length in order to provide the same thickness of insulation between cores and earth as between the cores themselves.

In the second type of joint (fig. 13) the conductors are separated from one another by an insulating spreader or separator of ebonite, china or similar material. The cores are sometimes taped over with insulating tapes, but with certain precautions this is not necessary and is best avoided. High-grade joint-box compounds possess very high dielectric strength and withstand higher breakdown pressures than insulating tapes, but their great disadvantage is the considerable shrinkage which takes place on cooling, and the liability for blow-holes or air-pockets to form in their mass.

Joints of either type may be filled either with an insulating oil or a joint-box compound (of a solid or viscous nature). Oil is objected to by many engineers, who fear its being absorbed up the cores of the cables; the author has yet to meet a case where a breakdown has occurred from this cause. The author considers it important that a joint insulated in the manner shown in fig. 12 should be filled with an oil, and that the outer insulation over the three cores should be put on in the form of bands at intervals along the cores, as in fig. 14, rather than wrapped over the whole length of the cores, as this, especially if a solid joint-box compound be used, will leave large air spaces all round the cores which the compound cannot penetrate. The cores should also be separated at intervals by similar bands of insulating tape, so as to allow free access to the oil, which will keep the insulating tapes constantly impregnated.

With the second type of joint (fig. 13), where solid joint-box compounds have been used, breakdowns have occurred due to shrinkage of the compound taking place in solidification after the joints have been filled. The hole due to shrinkage always forms at the ends of the cores and draws out air from the cores; this air pocket causes breakdown of the joints due to sparking which takes place from core to core across the air space. By insulating the cores separately with insulating tapes before the joint compound is

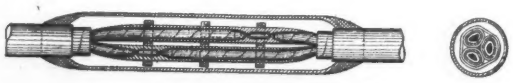


Fig. 14.

run in, this drawing out of air from the cores can be avoided, and breakdowns from this cause prevented; an oil filling should in such cases be use. In a joint of this type the author prefers that the cores should not be taped over, and that a viscous joint-box compound be used which never sets and in which cavities cannot form.

From the point of view of skill required in making them, joints of the type fig. 13 have the advantage, as the conductors are well apart, and it is only a question of the right kind of filling composition being used. A weak point, however, is the insulating separators, which in some cases have caused breakdowns, due either to moisture on their surface or to a film of air arising from imperfect adherence of the filling compound, the joints breaking down to earth *via* this surface.

In joints of the type shown in fig. 12, where the cores are in contact, breakdowns are certain if the jointer does not pay careful attention to the extraction of moisture from the insulating tapes; or if he does not put on a sufficient thickness; or if he wraps it on in a slovenly manner.

A joint which the author considers more reliable than either of the two types already discussed, and which does not call for such great

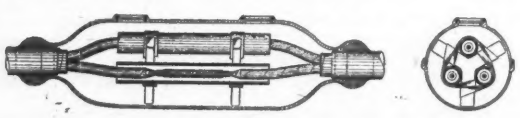


Fig. 15.

skill on the part of the jointer, is illustrated in fig. 15. In this type of joint the insulation is provided by loosely fitting tubes, preferably micanite, which are sprung over the cores, the conductor joint being left bare inside them and the tubes overlapping some distance over the ordinary paper insulation at each end. The tubes, which are split on one side with a lap joint, are finally taped over their whole length with two layers of insulating tape to keep them together, and the three tubes are separated by star-shaped china pieces taped down to them, which keep them apart and centre them in the lead sleeve. This sleeve is then filled in with the insulating composition, either an oil or a viscous joint-box compound—preferably the latter—which can run into the tubes and all parts of the joint box. It is important to space the china separators as far as possible from the ends of the tubes, so as to increase the leakage path between cores and to earth. It will be seen that in a joint of this type the risk of puncture between cores, as in fig. 12, is avoided, the workmanship is of the simplest description, and with a suitable joint-box compound, breakdowns are not likely to be caused by air.

Such a compound must be viscous and of about the consistency of thick cream at ordinary temperatures. When heated it should run as freely as heated oil, so as to penetrate all crevices, and it must retain these features throughout its life. If oils are used they must always be carefully freed from all moisture before use.

The last point is the containing sleeve, and the making of the joint watertight. Lead sleeves are almost exclusively used in this country on E.H.T. cables, and are wiped on to the lead of the cable at each end and at all joints in the sleeve itself. When cast-iron joint boxes are used, all joints in the castings should be faced to make them watertight, and the box should be bonded across by a cable. Another type of sleeve more recently used consists of a wrought-iron barrel, which should be similarly bonded across. It is usual to enclose all joint boxes in a wood or earthenware box filled in with pitch or bitumen, which acts as a protection against corrosion.

All material used, such as pitch, oils, compounds, and linen tapes, as well as any suspicious water or soil encountered, should be submitted to a chemist for examination; in perhaps no branch of engineering work is there greater need for close co-operation between the chemist and the engineer. Once cables are laid down, there is no opportunity of remedying mistakes except at very great cost, and cables are expected to last for from 20 to 30 years without inspection.

Where bad cases of electrolysis have occurred it has generally been found to be due to excessive leakage from tramway undertakings or from three-wire continuous-current networks. When this excessive leakage has been removed and the Board of Trade regulations complied with, electrolysis has been greatly minimised, if not altogether prevented.

Messrs. J. G. and R. G. Cunliffe pointed out that electrolysis is chiefly confined to metal pipes and cables laid within 3 ft. of tramway rails, and the author's experience, where the Board of Trade regulations have been adhered to, would seem to confirm this; but practically every case which has come to his notice has been due to neglect of these regulations.

Undertakers operating in colliery and other mining districts at times experience serious trouble from the pulling out of joints or cable breakdowns due to subsidence or earth movements. These are much more frequent on solid laid cables than on either drawn-in or armoured cables. Sometimes compression of joints, or cable bursts, are met with.

When the ground subsides, the lead sheath is able to stretch quite easily, and is in most cases unaffected. The conductors, however, do not stretch, and the conductor joints being generally the weakest point, these joints pull apart. Laying the cable with slack or snaked in the ground will not prevent this occurring. Cases of compression are generally caused by earth movements, which in some cases are quite extraordinary. Cables have been known to have a particular joint pulled out at one time and compressed shortly afterwards. In order to overcome troubles of this sort, the author has designed an expansion type of joint.* Joints of this type have been in use for about 18 months on several 20,000-volt cables on the power companies' systems in the Newcastle district, and have given very good results, no breakdowns of the joints or of the cables having occurred since their installation, although previous to this such breakdowns were very frequent. Joints opened up for inspection have shown movements of over 2 in. to have taken place, in some cases, in a few weeks. The latest joints installed provide for 6-in. movement in all. It is important that all joints in the affected area should be of the expansion type.

Power and railway companies who have cables laid alongside railway lines frequently experience breakdowns caused by the breaking of the lead sheath due to vibration from passing traffic. This trouble seems to be confined entirely to cables laid on the solid system, and takes place at the joints of the troughing. The vibration produces, first of all, crystallisation of the lead at these points, and finally the lead breaks through. The smaller the cable, the more severe is the trouble, and if a small cable and a large one are laid alongside one another in the same trench, the small one will always fail first. Serious cases have occurred on lead-covered cables laid within 2 ft. of tramways, which were laid on a bed of concrete in the usual manner. The remedy for this trouble is to use only armoured cables laid direct in the ground and at a greater depth than usual if within, say, a distance of 4 ft. from the rails.

Resonance, fortunately, is not a very common cause of failure under normal conditions of working. Cables have usually a very heavy factor of safety (between 10 and 20, as a rule). For this reason it has been found quite practicable to switch on and off long feeders direct on to the system without using any charging devices. Nothing else has ever been done on the large power companies' systems on the North-East coast, which were first put in operation in 1901.

Breakdowns on cables caused by pressure surges are usually quite characteristic; the insulation is generally perforated as if drilled through, or, if the breakdown is in a joint, fine burnt cracks are found through the insulation.

A large proportion of the breakdowns experienced arise from the use of lead for the outer waterproof sheath of cables. It would be

* Fully described in the Electrical Review, February 3rd, p. 201.

an advantage to use a non-metallic waterproof sheath, if one could be obtained, which retained the great advantages of the present lead sheath without its disadvantages.

Discussion.

Mr. John F. C. Snell said he noticed that as regarded the solid and drawn-in systems they were in practically the same position as seven or eight years ago. He had come across a case of cables laid solid in asphalt in iron troughing, where the latter had corroded away without injuring the system in any way. As an instance of the security of double-armoured cables laid direct, he mentioned a subsidence which had left a pair of these cables suspended between points a distance of 40 yd. apart, in which condition they were supporting a considerable weight of soil, &c.; these cables were intact and maintaining the supply as usual. He had given attention to the quality of the bitumen for solid laying, and now specified that it should begin to flow at a temperature of 80° F., and flow freely at 100° F. Personally, he thought it better to deliberately earth the cable sheathing at certain defined points. He asked what were the temperature limits of the 20,000-volt cables mentioned by the author, and what current density was permissible; he thought about 1,800 amperes per sq. in.

Mr. B. Wellbourn said he was glad to note the practical acceptance of paper-insulated lead-covered cable as the only means of transmitting at high pressure underground. He asked on what evidence the author had based the life of cable at 20 or 30 years. There were cables in use which had been down 21 years; the copper did not deteriorate, and a microscopic examination of the paper after 20 years' use did not reveal any defects, and he thought the references to ancient lead water-pipes were in favour of the longevity of the lead covering. One could make in the works and send out a better solid system than could possibly be made in the streets, and he thought the armoured cable laid direct in the ground was the only satisfactory system of mains laying. One reason why the solid system had received attention in late years might be traced to loan conditions; he thought the L.G.B. only allowed 15 years for repayment in the case of armoured cables, while 25 years was allowed for mains laid on the solid system. He thought the L.G.B. required educating in this matter. He agreed with the last speaker as to earthing at definite points, and said no trouble would arise from electrolysis if this were done properly and the sheathing made continuous. The expansion joints described were quite satisfactory; no trouble was experienced now with either 10,000 or 20,000-volt joints. For cables laid on railways he found it a good rule to keep 4 ft. from the edge of the track, and to pass under it at least 6 ft. below.

Mr. J. S. Highfield said that in his experience it was difficult to lay a satisfactory solid system, and he considered that a drawn-in system was better. In the case of some joint failures on the Metropolitan E. S. Co.'s system, on investigation it had been found that failure occurred at the point where the paper lapping met the tape; eventually oiled cable paper only was used, and such joints had withstood a test of 84,000 volts without breaking down. It was worth considering whether H.T. direct-current was not better for testing long lengths of H.T. cable, as capacity current would be avoided; 1 kw. would be sufficient, and up to 200,000 volts could be used.

Mr. W. H. Patchell said that in a colliery district he had considered it advisable to obtain clay in which to lay cables. A great deal of trouble in jointing arose from dirty handling; the tape should be used off a reel, and the jointer should not handle it.

Mr. Roger Smith, speaking on the subject of asphalt troughing which was used in connection with the Great Western Railway Co.'s power cables, said there was some 9½ route-miles in use, with 37 miles of H.T. cables and 51 miles of cable in all. At a test made the previous day on 300 yd., 2,000 ohms were obtained between sheathing and earth. The cable was laid five years ago; there were 600 joints, and only one failed during the contractor's year of maintenance. The cables crossed under the railway 27 times, and were laid generally in the 6-ft. way. In the middle of bridges the cables had splayed out sideways, through some unknown cause, but this had caused no trouble. Maintenance of the H.T. cables over the four years 1907-10 averaged £18 12s. a year; for the whole 51 miles, the average was £48, of which £16 was for telephone cables, and he did not think a system costing less than $\frac{1}{10}$th of 1 per cent. of its original cost for repairs could be considered unsuccessful.

Mr. W. M. Mordey pointed out that the resistance of a dielectric went down greatly with rise in temperature, which would explain failures in situations where hot water was encountered.

Mr. Howard suggested that the use of concrete in laying ducts was not so necessary now that many excellent ducts were on the market. Armoured cables were liable to fail eventually in water-logged or otherwise deleterious soils, and they were now often laid on a solid system.

Mr. A. P. Trotter said that cable-sheathing should be earthed at the most negative points of the system; earthing at frequent points only left paths for stray current to get in. Creosoted 2-in. planks in 12-ft. lengths were most favoured for protecting armoured cables, and if laid in suitable soil, such a system was the best to use.

The President said that had time permitted he would have had something to say as to the 10,000-volt cables from Deptford, which had been in use 22 years.

Mr. Vernier, in reply, said he based his idea as to the life of cables on known instances such as mentioned by the speakers; he could not say anything as to the 20,000-volt cables referred to in the paper. It was necessary to maintain continuously both lead sheathing and armouring, and while the most negative points should be earthed, frequent testing had to be carried out in order to keep in touch with other electrical developments in the area. The only difficulty in direct-current testing, as suggested by Mr. Highfield, was how to get the 200,000 volts readily. The Great Western troughing was laid on a concrete bed, and this kept the faults down, but faults from vibration on railways accounted for about 20 per cent. of the whole on his system, and that was a serious matter.

The Electrification of a Portion of the Suburban System of the London, Brighton and South Coast Railway.

By Philip Dawson, M.Inst.C.E.

(*Abstract of paper read before the* Institution of Civil Engineers *on March 14th*, 1911.)

In 1903 the company obtained Parliamentary powers to electrify their line, and instructed the author, as their consulting electrical engineer, to report to them on the advisability of electrifying their suburban system. He was to consider the question of experimentally adopting electric traction on their line between Victoria and London Bridge—known as the South London line—on which, since the London County Council had taken over the tramways and adopted electric traction, a very serious loss of traffic was being experienced. The third-rail continuous-current system was, as far as the Brighton Co. was concerned, not adapted for general use, nor was it in accordance with the requirements of the chief engineer of the company, Mr. Charles L. Morgan, M.Inst.C.E. In accordance with the recommendations contained in the Report, the single-phase alternating current, with overhead conductors at a pressure of 6,700 volts and a frequency of 25 cycles per second, was decided upon; tenders were called for electrifying the South London line in 1905, the contract being let on March 30th, 1906. The first electric train ran on January 17th, 1909, and the full public service was inaugurated on December 1st, 1909. The selection of the single-phase system was at the time very severely criticised by many engineers, and foredoomed to failure, but 13 months' regular working had entirely justified its adoption. The distance between London Bridge and Victoria is 8·7 miles, and the trains accomplish the distance, including 10 intermediate stops of 20 seconds each, in 24 minutes. The results obtained on the South London line were so satisfactory that the Brighton company decided to extend the system from Battersea to the Crystal Palace and Selhurst, and from Peckham Rye *viâ* Tulse Hill to the Crystal Palace, thus bringing the total length of route electrified to 23 miles, equivalent to 62 miles of single track.

The minimum drop in the earth-return is limited by the Board of Trade to 20 volts, and it is to be noted that neither the Lancashire and Yorkshire nor the North-Eastern Railways had any such limits imposed upon them, as they were electrified without requiring to obtain special Parliamentary powers. The system of distribution and feeding was specially designed to meet these requirements, and series booster-transformers were used, which have given excellent results, the return drop being well within the required limits. The current for operating the trains is furnished to the Brighton Railway Co. by the London Electric Supply Corporation, from their power station at Deptford, and they deliver the current on to the railway company's property at Queen's Road and Peckham Rye, where it is metered for payment.

The rolling stock of the South London line comprises 16 motor-coaches, each equipped with four 115-H.P. Winter-Eichberg compensated repulsion motors, and 32 trailer-cars, the trains being made up in units of two, three, or four coaches as required. The rolling stock for the extension now nearing completion comprises 30 motor-coaches, each equipped with four 150-H.P. Winter-Eichberg motors, and 60 trailer-coaches, the train units being composed of two, three, four, six or nine coaches. Difficulties have been experienced, particularly in America, with overhead conductors; but owing to the flexibility of the design employed, no trouble has been experienced, and the extensions are being constructed to exactly the same design as those originally got out for the South London line. The diameter of the trolley-wire is ½ in., and it is supported by two catenary wires, by means of specially-designed insulators of a type not hitherto used for railway work. Owing to the fact that at Victoria Station porters had to get on to the roofs of the carriages in order to light gas-lamps, the height of the conductor is 20 ft. in this station and at London Bridge; whereas the normal working height is 16 ft., and the lowest position under certain low bridges is 13 ft. 9 in. Double insulation is used throughout, and the only type of insulation employed is porcelain. The underframes of the coaches consist of plate girders, and the carriages themselves are of a new type as regards this country, being fitted with side doors and having a passage-way between compartments.

The motors have four poles, and are fitted with six sets of brushes. The air-gap of the motors is 3 millimetres, and the synchronous speed is 750 R.P.M., although the motors are capable of developing torque at speeds higher than this. The gear ratio adopted, after the most careful calculations, as the most suitable for the service, is 4·24 to 1. The actual current taken per motor at starting on the low-tension side is 210 amperes, with a power factor of 29 per cent. Each motor-car is fitted with two main transformers, rated at 220 kw. each, one for each pair of motors. None of the high-tension circuits on the car are accessible, except when the collector bows are lowered and when all the high-tension gear is earthed; the collector bows are kept against the trolley wire with springs, which are brought into operation by means of a piston worked by compressed air. The contact surface is aluminium, and

easily renewable, one contact-strip running 5,000 to 6,000 miles and taking practically all the wear; after 13 months' running no appreciable wear can be measured on the trolley-wire. The pressure of the bow-strip against the trolley-wire varies between 8 and 12 lb. The control of all the motors on the train is effected by means of contactors placed on each motor-car and worked by a master controller in every motorman's compartment, on the multiple-unit control system in every way similar to that in use with direct-current motors. The repair-shops are situated at Peckham Rye, and all maintenance and repairs of the electric trains are carried out here. These shops are fitted with electrically-driven travelling cranes, machine-tools, capstans, &c., and all the motors, as well as the lights, are taken off the single-phase traction circuit.

The overhead conductor has interfered very little with the signalling system.

The motors were tested very carefully by the author at the maker's works, and in addition to the ordinary measurements a test was made on a complete equipment rigged up as for service conditions with an artificial load on the motor. As much as 180 H.P. was repeatedly thrown suddenly on and off without any tendency to flash over. The largest starting torque measured was 255 kgm. (1,847 lb.-ft.). A series of tests was made to show the heating of the motors under varying loads, with the following results; the motors were run with open covers, the temperature rise not exceeding 75° C. :—

Load H.P.	Time for temperature to rise 75° C.
187	17 minutes
149	37 ,,
129	46 ,,
117½	1 hour 4 ,,
91	1 ,, 50 ,,
63½	1 ,, 50 ,,
57	continuous

For the trial runs between Battersea Park and Peckham Rye, a three-car train consisting of two motors and one trailer was used, being loaded up to a total weight of 146 tons. It was run continuously for 12 hours with 20-second stops at each station, and covered in this time a distance of 173·58 miles, the average length of run being 0·79 mile. At the conclusion of this run the maximum rise of temperature of any part of the electrical equipment was 66° C. During this test the following results were obtained:—Power-factor, 80·8 per cent.; maximum current at starting, 126 amperes; average acceleration, from 0 to 25 miles per hour, 1·75 ft. per second; and the power consumption on the train (which was a new one), 73 watt-hours per ton-mile. All the measurements showed that the test results were within the guarantees. After the train had run for some time further tests were taken which showed a considerable improvement as regards energy consumption, measurements at the distributing room at Denmark Hill showing, in the case of a single trip from Victoria to London Bridge, an energy-consumption of 65·7 watt-hours per ton-mile for a schedule speed of 22 miles per hour, including 20-second stops at each station. The influence of a long run on the energy-consumption is shown by the fact that for a through non-stop trip from Victoria to London Bridge at an average speed of 37 miles per hour, the energy-consumption was 34·4 watt-hours per ton-mile, the maximum speed reached during the run being 50 miles per hour. The following are some of the weights of the various component parts of this train :—

The complete motor-car on rails	53 tons	19 cwt.	3 qrs.	0 lb.
One motor-bogie without motors...	7 ,,	10 ,,	1 ,,	8 ,,
Motor-coach body and under-frame without electric gear	19 ,,	16 ,,	2 ,,	16 ,,
Total weight of all electric gear, including bows, wires, lighting, compressor, &c., for one motor-coach (four motors)	18 ,,	3 ,,	1 ,,	0 ,,

It is interesting to note that for a four-motor equipment consisting of 150-H.P. motors for the extension, the total weight is only increased by 19 cwt., thus showing the improvements which have been made in the design of the equipments.

The results obtained during actual running more than confirm the test results: thus, the average energy-consumption measured at Queen's Road (where the current is metered) for the first eight months of 1910 was 75·4 watt-hours per ton-mile, no allowance being made for weight of passengers carried, or for shunting or empty running; the figure given, furthermore, includes the energy used for light and power at the repair shops, and all losses due to leakage, &c. Tests made to ascertain the efficiency between the high-tension bus-bars of the power station and the trains showed that this was equal to 96·6 per cent., a very satisfactory figure. Calculations made from the results obtained during the running show that the efficiency of the system during controller notching is very high, the figure for this being 67 per cent. The traffic results obtained have been as satisfactory as the technical results. Thus, the record of the number of passengers carried by the electric service, as compared with those carried previously by steam, shows that whilst for the first month's working, namely, December, 1909, the traffic had increased over 54 per cent., the month of December, 1910, showed an increase of over 125 per cent.

The service on this railway is an exceptionally heavy one, as shown by the fact that for the first year's running the mileage per motor-coach owned, including all spares as well as those undergoing the annual overhaul, averaged 58,000 miles per annum. As regards the maintenance of the electrical apparatus, the first 13 months' experience shows no reason why the maintenance of single-phase should be higher than that of direct-current apparatus. The system is certainly more economical than the direct-current system as regards energy consumption at the power station, as well as regards first cost, and experience has shown it to be eminently suitable, not only for long-distance work, but also particularly for working in and out of large terminal stations with their necessarily complicated approaches, and for short-distance work, such as has had to be encountered on the South London line.

The principal contractors were the Allgemeine Elektricitäts Gesellschaft, of Berlin; all the overhead work has been carried out by Messrs. R. W. Blackwell & Co., and the rolling stock was constructed by the Metropolitan Amalgamated Carriage and Wagon Co., of Saltley, Birmingham. Great credit is due to the contractors for the excellent way in which the work has been carried out.

LEGAL.

An Electric Power Company's Accounts.

At the Middlesbrough Police Court on the 15th inst., the Cleveland and Durham County Electric Power Co., Middlesbrough, were summoned because, on or about October 12th, 1910, they, being the undertakers, refused to supply to Mr. Andrew Gemmell a statement of accounts for the years 1908 and 1909, in accordance with the Act of 1882.

Mr. Charlesworth, for the prosecution, said that the action was taken under Sec. 9 of the Electric Lighting Act of 1882, which required undertakers to supply a balance-sheet on or before March 25th of every year. They were also bound to supply a statement, at a fee of 1s. per copy, to anyone who made application for it, or they were liable to a fine of 40s. for each day. Mr. Gemmell made an application for balance-sheets for the years ended December 31st, 1908, and December 31st, 1909, enclosing in his letter a postal order for 2s. The company replied to the effect that the Board of Trade had not prescribed the form in which the accounts had to be published, and they, therefore, could not supply them, and returned the fee of 2s. Further correspondence took place between the company and Mr. Gemmell, and the latter then wrote to the Board of Trade, and received a letter stating that the Board had prescribed the form to the company in August. The accounts were eventually supplied to Mr. Gemmell on February 24th last. The excuse of the company, continued Mr. Charlesworth, was absolutely non-existent, for one account was audited and signed on August 25th, 1909. Furthermore, the accounts were not complete, for neither contained the Board of Trade auditor's report, but on further application this was sent by the company on March 1st. The company, in a letter, regretted that they had not been sent before. Still they were not complete, for the statement of electricity generated was missing, and he could quite see why they had delayed so long, because the auditor's report was very damaging. There was a delay of 138 days, and this worked out to £552.

Mr. Andrew Gemmell corroborated his solicitor's statement as to the replies he received, and added that on February 18th he received a letter stating that the company had received a letter from the Board of Trade stating the form in which the accounts were to be published, and they were then in a position to publish them. A few days after the summons had been served on the defendants, he received the accounts. They were then not complete, as they were without the auditor's report. Page 12 in each report, which should have shown the number of units generated, had been left blank. Witness wanted these figures because he was interested in a limited company which held 99 per cent. of the shares of the defendant company, and he wanted the accounts to assist him in a financial crisis which the limited company was going through.

In cross-examination, Mr. Gemmell admitted that he was secretary of the company at one time.

Mr. Monk: You have told his worship that the accounts were not in the form the Board required. What authority have you for stating that?—The Board of Trade auditor's remarks at the end of the 1909 report.

The Board of Trade are continually changing their auditors, are they not?—They have done so several times.

Was it not the practice of the Board of Trade to send the report of the auditors to the company first, and ask for their observations on it?—That did sometimes occur.

Was that not for the purpose of seeing how much of the report should accompany the accounts?—I do not think that is so.

I think, Mr. Gemmell, you were rather anxious that the Board of Trade should take some action against the company?—I don't think so.

Didn't you try to stir them up?—No, I don't think so.

Mr. Monk, for the defence, said if he could prove that the statements of accounts could not have been supplied on the date of the application, he thought the case failed.

Mr. Arnold Gridley, general manager of the company, said that it was February of 1911 before they got the order from the Board of Trade to publish the part of the report they thought necessary, and at the same time they received the order for the 1909 account. They had one other application for a copy of the

accounts, and this was dealt with in the same manner as Mr. Gemmell's.

Questioned by Mr. Charlesworth, Witness said he did not think there was anything in the auditor's report which was damaging to the company. The accounts were supplied to Mr. Gemmell as soon as it was possible to give them.

The Stipendiary (Mr. C. W. Fry) said it was clear that the accounts could not be published unless the report of the auditor was appended to them. He thought it was also clear that when the application for the accounts was made, the company were in correspondence with the Board of Trade as to which portion of the report should be used, and he thought that Mr. Gemmell had been supplied with the accounts as soon as it was possible to supply him. He therefore dismissed the case. He granted an application by the defence for solicitor's costs.

Humphreys *v.* City of London Electric Lighting Co., Ltd.

On Saturday, March 18th, in the second Court of Appeal, this case came before the Master of the Rolls and Lords Justices Fletcher Moulton and Buckley, on the respondents' application for security for costs.

Counsel stated that the appeal was by the workman who on November 16th, 1908, while in the employ of the respondent company as an electrician, received injury to his hands. His wages were 32s. 6d. a week, and he was paid 16s. 3d. until August 16th, 1909, when he was given work as a watchman at a weekly wage of 25s. After some correspondence he agreed to accept 3s. 9d. a week compensation, which was half the difference between the 25s. he was then earning and the 32s. 6d. he was earning at the time of the accident. The payments were made to him and accepted by him for considerably over 12 months, when he put forward a claim to the whole of the difference and took the matter before the County Court. The learned County Court judge had found that the proper amount payable by the company was 3s. 9d. a week, and from that decision the workman was appealing.

Their Lordships saw no reason for requiring security and dismissed the application.

Workmen's Compensation Case.

Judgment was delivered on Saturday, March 18th, by the Master of the Rolls and Lords Justices Fletcher Moulton and Buckley, in this Workmen's Compensation case, which raised the question of the employer's liability to continue compensation where the injured man was capable of doing light work, but unable to obtain it.

It appeared that the applicant workman, named Hall, was in the employ of the Cardiff Corporation in connection with certain tramways taken over by them, and while acting as overhead wireman, fell from the "tower," a distance of 20 ft., and broke his right arm. For a time he received compensation, and the arm remaining injured the Corporation found him light employment. In 1908 he was thrown out of a trap driven by the traffic manager, and his left arm was injured. Compensation was again paid for a time, when it was stopped, but after examination by the Medical Referee, the County Court Judge awarded him 9s. 2d. a week. On the ground that he was physically able to do light work, this was subsequently reduced to 8s. a week, though the evidence was that the man had tried to obtain light work, and had failed. The applicant appealed from that decision on the ground that upon the evidence there was nothing to justify the County Court Judge in making the reduction.

The Master of the Rolls in giving judgment, said that in his opinion the appeal ought to be allowed, but the other members of the Court were of a different opinion, and it would be dismissed, with costs. It was clear that the second accident prevented the man from performing the work he had followed. It was clear, however, from the evidence that he was able to do light work, but it was also clear that he had made numerous attempts to obtain it, and had failed, and there was no suggestion of malingering. In his opinion, it was not enough to prove physical ability to do certain work, but the employer must show that the man could obtain such work as he was capable of doing in the neighbourhood.

Lord Justice Moulton said that the evidence before the County Court Judge was that the man's condition had greatly improved, and therefore he was justified in reviewing the amount of the payment. It was no fault of the employer that the man was unable to obtain suitable light work, and the employer could not be held responsible for the state of the labour market.

Lord Justice Buckley, in agreeing with Lord Justice Moulton, said the question was not whether the workman was unable to obtain work, but whether as the result of the accident he was incapacitated from obtaining work.

In accordance with the opinion of the majority of the Court, the appeal was dismissed with costs.

Arc Lamps, Ltd.

In the Companies' Winding-up Court, Chancery Division, before Mr. Justice Swinfen Eady on Tuesday, March 21st, the petition of Messrs. Siemens Bros. Dynamo, Ltd., for the compulsory winding up Arc Lamps, Ltd., was heard.

Counsel stated it was a judgment creditors' petition. A meeting of the creditors was held on Monday, and a statement of affairs was laid before them. It was arranged, subject to his Lordship's sanction, that the petition should stand over for three weeks. A Committee of Inspection was appointed at the meeting.

His Lordship: Is there a voluntary winding up?

Counsel replied that there was not.

His Lordship: Well, what is a committee for?

Counsel replied that it was an informal meeting of creditors which appointed the committee of inspection. He asked that the petition should stand over for three weeks, in order that some arrangement might be made. The company had issued debentures, and one of the debenture-holders was one of the persons who was appointed to consider whether some arrangement could be made.

His Lordship said he would let the petition stand over for a fortnight.

Stud Tramway Case Appeal.—Griffiths & Bedell *v.* Benn

This case came before the Court of Appeal, consisting of the Master of the Rolls and Lords Justices Moulton and Buckley, last week, upon the application of the defendant for judgment or new trial in the action, which was tried before Mr. Justice Ridley and a special jury. The case has been fully reported in the Electrical Review.

Sir Edward Clarke, K.C., and Mr. H. McCardie appeared for the appellant; and Mr. F. E. Smith, K.C., Mr. J. B. Eames for the respondents (the plaintiffs).

Sir Edward Clarke, K.C., after stating the facts and reading the alleged libels, said that on the face of the documents there was no defamation of either Mr. Griffiths or Mr. Bedell. The question before the Court was that proposed by Lord Blackburn in the Capital and Counties Bank *v.* Henty. Applying that test, the whole case in the Court below had proceeded not on the question of defamation of the plaintiffs, but on the attack on the system, what was called a trade libel. A large portion of the time occupied by the trial had been occupied in a discussion as to the conduct of the officers of the London County Council. The attack on those officers had been abandoned by Mr. Green in his closing speech for the plaintiffs, but whatever their conduct might have been Sir John Benn was in no way responsible for them, and the whole of this issue was irrelevant. With regard to Mr. Griffiths, not a single question was put in his examination suggesting to him any defamation of him. It was said that Mr. Griffiths was examined very shortly, but in the examination of Mr. Bedell there was not a suggestion that there had been defamation of him. In the re-examination of Mr. Bedell, a great deal had been made of the passage in Sir John Benn's speech that the Moderate party said that services for the health of the community, such as tramways, should be managed by the trust and the companies in the interests of those financiers. Counsel would ask the Court to bear in mind that this was one of the only two passages which were alleged to defame either of the plaintiffs personally. The only other sentence relied on was the statement that the Progressive system did not, perhaps, commend itself to the Moderates, because it happened to be free of any royalty to patentee or company. It was attempted to suggest that this sentence should be read as implying that every patentee or company who had dealings with the Moderate Party was guilty of dishonourable conduct in complicitiy with the Moderate Party. Mr. Bedell, the plaintiff, on whom rested the onus of proving defamation, had in his cross-examination said that he waived the point of defamation so far as it arose on the speech at Mile End Road. Counsel submitted that passages which he read from the evidence showed that there was no libel on either Mr. Griffiths or Mr. Bedell. If that was so, the appellant was entitled to judgment, because the only thing that remained was the trade libel; but to support a trade libel it was necessary to prove special damage, and the jury had not found any special damage in the present case. A further submission was that, even if the words spoken were defamatory, they were spoken in such circumstances that they were fair comment.

The Master of the Rolls here suggested that as judgment was asked for on the ground that the expressions used were not defamatory, it might be convenient for the Court to deal with that point first before going into the other questions.

Sir Edward Clarke then proceeded to read the learned Judge's summing up.

Mr. F. E. Smith, K.C., on behalf of the plaintiffs (respondents), cited cases in support of his contention that the defendant had defamed the character of the plaintiffs by his attack upon the stud trams laid down in the Mile End Road.

The Master of the Rolls said he did not understand that the plaintiffs, or either of them, were in the position of traders laying down tramways. They only supplied the parts.

Lord Justice Moulton said that there was not a suggestion from beginning to end in what the defendant had said and written that there was any bad workmanship in these parts.

Mr. Smith submitted that the suggestion was made by inference over and over again.

The Master of the Rolls: How does the libel attack Mr. Bedell?

Mr. Smith: He was the manager, had a share in the profits, and was the patentee. To say that the system was worthless and dangerous would be a libel on the patentee.

Lord Justice Moulton: But to say that a patent is of no use is no libel upon the patentee. I cannot find an attack on the workmanship. I can only find an attack on the policy of adopting the system. Defendant was attacking the party which adopted the system and not the goods supplied by the plaintiffs. I cannot find the slightest suggestion that Mr. Griffiths had adapted the cars or supplied the parts badly. The "G.B." system as laid down in the Mile End Road was a failure.

Mr. Smith said that the plaintiffs' whole case was that it was

an admirably efficient system, and that it failed because the L.C.C. would not allow the plaintiffs to undertake the engineering work. The whole thing was bungled.

Lord Justice Moulton: You cannot say that there is anything in the libels to show that the parts were bad.

Mr. Smith: They have been called "jerry-built" trams.

Lord Justice Moulton: That only refers to the building of the trams.

Mr. Smith: To say that these trams were "jerry built" was a distinct imputation on the parts which we supplied.

Counsel went on to read a newspaper headline over one of the defendant's speeches, "Fifty Live Studs a Day," and said that the plaintiffs supplied the studs.

Lord Justice Moulton: You did not supply live studs.

Mr. Smith: That was the whole point of the charge against us; the studs were live when they should have been dead.

Lord Justice Moulton: I cannot see a single word in the libel that attacks the plaintiffs. It was not a representation that the manufacturers supplied bad goods, but that the system itself was a bad one for London.

Mr. Smith: To say that the studs we supplied were "live" studs was a reflection on the system and upon the plaintiffs as traders.

Lord Justice Buckley: Sir John Benn is reported to have said "They are still tinkering in this magnificent thoroughfare with a system which all competent experts have declared to be unsuited to London." It seems to me that to constitute that a libel you want a further suggestion that the plaintiffs knew this system was unsuited to London when they sold it.

Mr. Smith: No, my Lord, I think not. The charge is made that we were inexpert in our business.

Lord Justice Moulton: The system may be all right in other places; it is no use in London.

Mr. Smith: I submit that the defendant went much further than that.

Lord Justice Buckley: The defendant blamed them for installing a system which was unsuitable for London.

Mr. Smith said that it was suitable for London.

At this stage it was agreed that Mr. Eames (Mr. Smith's junior) should read those parts of the evidence given in the Court below which he considered material, and the hearing was adjourned till Monday.

On Monday, Mr. Eames continued the reading of the evidence and having concluded doing so, contended that the learned judge was right in leaving the case to go to the jury, and that the verdict ought not to be disturbed.

Sir Edward Clarke, in a short reply on behalf of the defendant, contended that in what the defendant had said and written there was no personal defamation of the plaintiffs, and that judgment ought to be entered for the defendant.

The Master of the Rolls, in giving judgment, said that the question upon the appeal was whether certain words written and spoken by the defendant were capable of being defamatory of the plaintiffs in their business, or whether they were only defamatory of the "G. B." system of which Griffiths, either alone or with Bedell, was patentee. After a trial extending over many days, the learned Judge having declined to rule that the words used by the defendant were not capable of being a libel or slanderous, the jury found that the words were defamatory; that they referred to the plaintiffs; that they did not express mere matters of opinion, but were statements of fact; that they referred to the failure not only in the Mile End Road, but to the system in general; and that the facts, or many of them, were untrue; that the defendant was actuated by malice, except on two occasions when there were debates at the L.C.C. which were privileged, and the jury disagreed as to whether the plaintiff or either of them had suffered special damage, but they gave general damages to the amount of £12,000, to be divided equally between the two plaintiffs. Now he accepted the view which the jury obviously took, that the defendant's statements were inaccurate; secondly, intemperate; and thirdly, tainted by political prejudice; and further, that no special damage was proved. It remained to see what followed upon those findings. It was the right and duty of the Court of Appeal to consider whether the words complained of were capable of being defamatory in the sense of being a personal attack on the plaintiffs in the sense that a fair-minded man would understand them. If, after careful consideration they arrived at the conclusion that the words were not of a defamatory meaning, judgment must be entered for the defendant, notwithstanding the verdict of the jury. To disparage a trader's goods which was sometimes, but inaccurately, spoken of as a trade libel, did not give ground for an action for libel if special damage was not proved, but if proved the plaintiff might recover on an action on the case. Had the plaintiffs satisfied the onus of showing that the words used conveyed to the man of reasonable mind a personal imputation on their character, or the mode in which their business was carried on? Now the L.C.C. were minded to try a stud system of electric tramways, which was in successful operation at Lincoln. They obtained a licence from Griffiths, and Griffiths supplied the parts, but did not do the work of installation. This was undertaken by the L.C.C. There was some ground for the plaintiffs saying that the defects were due to the installation. Live studs were found, and the system was ultimately abandoned. Meanwhile the stud system on the one hand, and the conduit system on the other, became identified with the Moderate and Progressive parties respectively, and the defendant took a decided stand on the matter, and wrote and published the alleged libels and slanders. His Lordship then referred to the article in the *Daily Chronicle*, which was written by the defendant, to the defendant's letter to the *Times*, and some of the defendant's speeches which were complained of. He could not find in the alleged libels, or in any statement of the defendant, a suggestion that Griffiths had laid down a jerry-built tramway, or that the workmanship on his part was defective, or that he was in any other position but that of patentee receiving royalties. It seemed to him too extravagant to argue that an attack on the system must be regarded as an imputation on the owners of the patents who supplied the parts and licensed the use of the system. Bedell was simply the inventor, a skilled electrician, and employed by Griffiths as manager. He thought the appeal should be allowed, and judgment entered for the defendant, with costs there and in the Court below.

Lords Justices Moulton and Buckley delivered judgments to the same effect, and the appeal was accordingly allowed, and judgment entered for the defendant with the costs of the appeal and in the Court below.

Mr. F. E. Smith applied that the defendant's solicitor should be directed to give an undertaking to repay the taxed costs if the plaintiffs appealed to the House of Lords and the appeal proved successful, but the application was refused.

PARLIAMENTARY.

London, Tilbury and Southend Railway Bill.

On March 14th Lord Southwark's Select Committee of the House of Lords considered the above Bill, which authorises the company to raise £75,000 additional capital, and to erect generating stations. Mr. H. Lloyd, K.C., and Mr. W. Szlumper appeared for the promoters, and Mr. J. C. Fitzgerald, K.C., and Mr. Courthorpe Munro were for the London and Thames Haven Oil Wharves, Ltd.

Mr. Lloyd, K.C., said there were a number of domestic matters in the Bill to which there was no opposition, but the main object was the proposal to utilise some land belonging to the company for the purpose of erecting thereon generating stations in order to work the line by electricity. The company owned 80 miles of railway, and the Bow and Whitechapel Railway was the joint property of the company and the Metropolitan District Railway Co. From Bow to Barking the line had been doubled, and there were four sets of rails, two of which were used for steam traffic and two for the electric traffic. In 1902 the company obtained Parliamentary powers to electrify the railway, and they had spent £866,000 in adapting portions of the line for electrical working. The company were now contemplating converting other parts of their line to electrical working, and there was little doubt that eventually the whole of the line would be so worked. Under these circumstances it was desirable that they should make provision for a proper generating station. When the Act was obtained in 1902 the company made provision for a small generating station to work part of the line, as was then anticipated, but it had not been necessary to construct this, because a supply of current had been obtained from the generating station of the Underground Co. at Lot's Road. The time was coming, however, when the company was advised that it was necessary they should provde themselves with generating stations, and that was why they were now before Parliament. They had scheduled two sites on which to erect stations. The first one was at Tilbury, and there they were met by the objection of the Port of London Authority, who said they had a project under consideration for constructing a large landing stage, where ocean liners might draw up to discharge cargo. They had arranged with the Port of London Authority to construct their generating station a little further off, and thus had disposed of that opposition. The second site was at Thames Haven, and here they were met with the opposition of the London and Thames Haven Oil Wharves Co., which had a capital of £170,000, and owned land adjoining the railway, and had certain statutory rights of way over the railway. In their petition the Thames Haven Oil Co. asserted that the bulk of the petroleum spirit brought to London was discharged at their wharves, and it was stored in 57 steel tanks, which were all connected with pipes. Some 200,000 tons of petroleum were stored at one time, of which 60,000 tons were spirit. They contended that if the line was electrified and the generating station were erected in close proximity to the wharves, their property would be endangered. They said that the company would not be able to prevent flashing of the conductors when trains were passing, and this would be a distinct danger. His answer to this was that the company had already power to electrify the line, that there was no danger, and further that the oil company had already a generating station themselves in the middle of their stores. The only objection which really applied to the present Bill was that in which it was said that in generating stations where large quantities of energy were produced at high pressure, currents were produced in the earth, and in case of breakdown they increased the pressure very greatly. The petitioners said that these currents would pass along their pipes and cause electrolytic corrosion and consequent leakage. In answer to that, he would remind the Committee that the station would be on the railway company's own land a quarter of a mile away, and he could assure the Committee that there was no danger of any of these terrible things as alleged. As a matter of fact, the Charing Cross and Strand Electricity Co. had a great generating station in close proximity to another store of the Thames Haven Co.

Mr. A. Stride, managing director of the London and Tilbury Co., said the agreement of the company with the Underground Co.

for a supply of electricity would last for a few years longer, and they had been advised by engineers that it was necessary to provide for emergencies. They did not anticipate the slightest danger to the oil company.

Cross-examined by Mr. Fitzgerald, Witness said that when they got the 1902 Act, they obtained power to erect a generating station at Barking, and they were also given power to supply to other companies. He was aware that the Lot's Road generating station had the capacity to supply current to much beyond its present output. He did not suggest that they wanted three generating stations to supply their line, but he did think they wanted two. He was not in a position to say whether or not the Underground Co. at Lot's Road could produce electricity at a cheaper rate than his company could supply itself.

Mr. Fitzgerald put it to witness that the company could now erect a generating station on their land, but would be liable for any damage done to their neighbours, and that the sole reason for the company asking for Parliamentary powers was to get rid of this liability.

Witness said that was not so. They wanted facilities for working the line, and especially for carrying out developments at Thames Haven which they had in mind.

Mr. Robt. Hammond, M.I.E.E., said he had been called in by the company to advise on the matter before them. At present the line electrified was worked from the Lot's Road station.

Is that an economical arrangement?—Well, they would not have entered into the bargain if it had not been economical, but a big railway company desiring to electrify the whole of its line of 80 miles certainly ought to have a generating station itself. Of course, the more Lot's Road station makes, the cheaper it makes it.

Continuing, Witness said the two sites selected were ideal from the engineer's point of view for generating stations. Thames Haven was a desolate spot. The generating station there would be 300 yards from the Pig and Whistle, which was the only house in the neighbourhood not belonging to the company.

Cross-examined by Mr. Munro, Witness denied that the generating station would be any risk to the oil wharves. At the present time for the portion of the line electrified the company had power to use insulated return for its low pressure or uninsulated return, but they were under such stringent conditions as regard the uninsulated that they preferred to send their return insulated. They would not object to insulate the return current at the line near the wharves.

Mr. Fitzgerald said that would satisfy his clients.

After consultation, Mr. Lloyd said they had given the petitioners an undertaking that when they electrified their lines at this spot they would construct it in the same insulated way as their existing line was constructed. They were also willing that the petitioners should have two subways connecting their land on either side of the line, for one of which the railway company would pay while the petitioners would pay for the other.

The opposition having withdrawn, the preamble of the Bill was declared proved.

German Rails for Birmingham Tramways.—Mr. MacVeagh asked the President of the Local Government Board whether his attention had been called to the action of the Birmingham Corporation in buying German rails for the Soho Road tramways in that city; whether he was aware that when the London County Council bought £41,000 worth of Belgian rails, it was computed by a competent authority that only £1,000 was saved to the rates, whilst £20,000 went to Belgian instead of British labour, and whether the attention of the Local Government Board auditor would be drawn to the circumstances.—Mr. Burns replied that he saw the statement in the Press on the subject. The matter of the purchase of rails for tramways in Birmingham was not, however, one in regard to which he had any jurisdiction.

Great Northern Railway Bill.—This Bill was before Mr. Walter Guinness's Committee of the House of Commons on March 15th and 16th. The only clause dealing with electricity was Clause 81, by which the company sought power to take a supply of electrical energy for the generating station of the Great Northern and City Railway Co. The clause was opposed by the Islington Borough Council. Mr. O. H. R. Bury, general manager of the Great Northern Railway Co., stated that they subscribed £50,000 to the power station of the Great Northern and City Railway Co., and had spent £450,000 on the making of that railway under Finsbury Park. At present they got their electricity for lighting from the company's own generating station at Holloway, but the cost of manufacture was rather heavy, and they could get a supply from the City Railway Co. at a much cheaper rate. They had agreed with the Board of Trade not to use any electrical energy so obtained for the running of trains over any railway which they were not authorised to work by electrical power. The Committee passed the clause, and, having declared the preamble as a whole proved, ordered the Bill to be reported for third reading.

Belfast Corporation Bill.—The Standing Orders Committee of the House of Commons has dispensed with the standing orders in regard to the above Bill, on condition that Tramway No. 6 is struck out. This refers to about half a mile of tramway proposed to be constructed in the Rural District of Castlereagh.

Metropolitan Electric Tramways Bill.—It has been decided by the Standing Orders Committee of the House of Commons that the Metropolitan Electric Tramways Co. may proceed with their Bill, provided that they strike out Tramways 1 and 2. These refer to short lines at Walthamstow and Enfield.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

TUNIS.—The following duties are payable on electrical and similar goods:—

	Francs per 100 kg.
Aluminium	8 % ad val.
Iron or steel wire, tinned, coppered, zinced, galvanised or not:	
More than 2 mm. diameter	7
" 1 " and not more than 2 mm.	10
From $\frac{5}{10}$ mm. to 1 mm. diameter	12
Less than $\frac{5}{10}$ diameter	20
Rails of iron or steel	6
Copper wire	10
Porcelain of all kinds	8 % ad val.
Glass articles not specially mentioned in the Tariff	8 % "
Electrometers and generally all meters or measuring apparatus fitted with clockworks	1 % "
Steam engines, steam pumps, gas, petroleum, hot air and compressed air engines weighing:	
250 kg. and more	12
Less than 250 kg.	20
Steam engines, semi-portable or portable, including boilers	13
Hydraulic turbines, pumps, ventilators, weighing:	
More than 3,000 kg.:	
Containing at least 50% of cast-iron	8
" less than 50% "	10
From 250 to 3,000 kg.	10
Less than 250 kg.	15
Dynamo armatures and detached pieces such as induction coils, solid or hollow, of metal surrounded by insulated copper; worked parts of metal, fitted together or not, for electrical machines, electrical apparatus, electro-technical apparatus, transformers, &c., weighing:	
2,000 kg. or more	35
From 1,000 to 2,000 kg.	40
From 200 to 1,000 kg.	45
From 1 to 200 kg.	60
Less than 1 kg.	75
Arc lamps (regulators)	60
Electric accumulators	16·50
Miners' fuses of all kinds	8 % ad val.
Railway or tramway carriages, upholstered or not:	
Ordinary gauge:	
For railways	8 % ad val.
Tramway carriages	16
Narrow gauge: railway and tramway carriages	8 % ad val.
Bodies or parts of bodies	8 % "
Articles of asbestos with or without admixture of textile or mineral substances	8 % "
Instruments, scientific	free
Dynamos weighing 5,000 kg. or more:	
Containing at least 50 per cent. of cast-iron	12
" less than 50 " " "	20
From 2,000 kg. to 5,000 kg. exclusive	
Containing at least 50 per cent. of cast-iron	18
" less than 50 " " "	20
From 1,000 kg. inclusive to 2,000 kg. exclusive	20
" 50 " " 1,000 "	30
" 10 " " 50 "	80
Steam boilers:	
Of steel or iron plate, sectional or not, but without tubes	9
Ditto, tubular or semi-tubular	14
Parts of multitubular boilers, composed chiefly of iron or steel tubes, fitted or not	18

Fly-wheel Equaliser for Ore Hoists.—In the *Electrical World* of February 23rd, a fly-wheel equalising set, consisting of a 300-kw. d.c. machine coupled to a 25-ton fly-wheel, for equalising the load on a dock supply system, is described as the first of its kind operating in conjunction with a rotary converter supplied from an a.c. source. This is no doubt correct, but a very similar system, by which the like purpose is served, was installed at the Rothesay Dock, Clydebank, two years ago; it was described in the paper by Messrs. Dixon and Baxter abstracted in our issue of February 3rd. In the system installed at the Toledo ore docks there are two large combined hoists and transporters for unloading vessels at the rate of 400 tons per hour each. The fly-wheel-generator is a compound-wound machine, normally running as a motor; when the load on the bus-bars exceeds a certain value, a relay causes the series winding to be short-circuited, and the machine then runs as a shunt-wound generator, sharing the peak load with the rotary converter. Automatic switches cut out resistance from the field circuit so as to maintain the voltage of the machine while the speed of the fly-wheel falls, on the Ward-Leonard system, down to 80 per cent. of the normal speed, and the set is able to carry a load of 850 kw. for 15 seconds before reaching this limit.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

5,521. "Current graduating devices or resistances applicable for electric lighting or heating." W. Sumner. March 6th.

5,580. "Actuating gear for magnetos and dynamos for electric ignition and similar purposes." F. H. Micklewood. March 6th.

5,585. "Device for automatically indicating when the brakes and driving power are simultaneously applied to an electric car or other vehicle." W. R. Elliott. March 6th.

5,563. "Method of supplying electricity to consumers on the maximum demand system." F. T. R. Murray. March 6th.

5,564. "Electric contact keys or the like." W. M. Crowe and British L. M. Ericsson Manufacturing Co., Ltd. March 6th. (Complete.)

5,569. "Electric conductors." Ges. fur Elektrotechnische Industrie m.b.H. (Convention date June 28th, 1910, Germany.) March 6th.

5,594. "Holders for electric lamps." G. H. Cottam. March 6th.

5,620. "Electric motor control." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) March 6th.

5,622. "Electric lamps." R. Belfield. (O. M. Thowles, United States.) March 6th. (Complete.)

5,654. "Electricity meters." Chamberlain & Hookham, Ltd., and S. James. March 7th.

5,696. "Pen oscillating by electric power." G. F. Thorp. March 7th.

5,700. "Working of electric railways." G. I. H. Davidson. March 7th.

5,714. "Electric arc lamps." F. Von Madaler. March 7th.

5,727. "Electric cables." W. S. Smith and W. P. Granville. March 7th.

5,734. "Anodes for use in the electrolytic treatment of alkaline salt solutions." A. T. K. Estelle. (Convention date, March 9th, 1910, Sweden.) March 7th. (Complete.)

5,745. "Boxes for use with electric cables, telegraph, telephone and the like, applicable also for other purposes." H. Dickinson. March 8th.

5,752. "Metal filaments for electric lamps." J. A. Gartell. March 8th.

5,766. "Connections of dynamos used for three-wire supplies." Brush Electrical Engineering Co., Ltd., and M. L. Kahn. March 8th.

5,789. "Telephone call register." E. S. Rayner. March 8th.

5,790. "Sparking plugs for electrical ignition purposes." L. R. Jones. March 8th.

5,806. "Electric arc lamps." J. O. Girdlestone and C. F. G. Thorkelin. March 8th. (Complete.)

5,812. "Channels or drums for underground cables and method of manufacturing such drums." C. A. W. Hultman. (Convention dated April 7th, 1910, Sweden.) March 8th. (Complete.)

5,813. "Apparatus for manufacturing conduits for underground cables." C. A. W. Hultman. (Convention dated April 9th, 1910, Sweden.) March 8th. (Complete.)

5,828. "Switches and interrupters for electric circuits." H. R. Schultz. March 8th.

5,844. "Switch-operating mechanisms." G. Rossi and D. Miaro. March 8th. (Complete.)

5,856. "Electrical switches and controllers." F. Garside. March 8th.

5,866. "Electric motors." Anschutz & Co. (Convention date, November 18th, 1910, Germany.) March 8th. (Complete.)

5,870. "Hub motors for electrically-propelled automobile vehicles." V. Harhorn. (Convention date March 12th, 1910, Germany.) March 8th. (Complete.)

5,871. "Reversing switch for electric hub motors for automobile vehicles." V. Harhorn. (Convention date, March 12th, 1910, Germany.) March 8th. (Complete.)

5,934. "Fixing devices for guards of electrically-driven fans and the like." H. E. Saxby. March 9th.

5,961. "Apparatus for measuring the relation of two electric currents." J. Carpentier. (Convention date, March 18th, 1910, France.) March 9th. (Complete.)

5,986. "Electric wall plugs." S. W. Martyn. March 9th.

5,993. "Control of electrically-operated switches." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) March 9th.

6,009. "Metal-filament electric lamps." H. C. Gover. March 10th.

6,017. "Electric firing devices for ordnance." W. Beardmore & Co., Ltd., A. Bremberg and A. Banks. March 10th.

6,049. "Automatic telegraph transmitters." K. L. Wood and Eastern Telegraph Co., Ltd. March 10th.

6,050. "Thermally-operated electric indicator." R. W. Nicol. March 10th.

6,066. "Lighting of electric incandescent lamps." G. F. Richardson and R. J. Crowley. March 10th.

6,071. "Electricity meters." J. H. McLean and W. L. Madgen. March 10th.

6,074. "Electrically-operated fountains." A. D. Southam. March 10th.

6,089. "Electric incandescent lamp and holder and switch therefor." S. B. Turner. March 10th.

6,095. "Control of electrically-operated switches." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) March 10th.

6,108. "Dynamo-electric machines." H. F. Foster. March 11th.

6,129. "Auxiliary electric light switch adaptor." A. Page. March 11th.

6,147. "Push-button electric switches." Hartmann & Braun Akt.-Ges. (Convention date, April 12th, 1910, Germany.) March 11th. (Complete.)

6,157. "Electrical supervision system." A. Goldstein. March 11th. (Complete.)

6,158. "Electric furnace for two or three-phase currents." A. L. Billon-Daguerre. March 11th.

6,179. "Electric lamps." H. E. Watson. March 11th.

6,189. "Electric ignition device for gas burners." H. Wasserzier. March 11th. (Complete.)

6,188. "Motor starting and protective devices." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) March 11th.

Aluminium in Italy.—It is announced from Milan that the Società Italiana per la fabbricazione dell' Alluminio, which was formed in 1904 by a Rome group in association with German capital and which has hitherto been unable to pay any dividend, proposes to reduce the share capital from £120,000 to £48,000. It is then intended to proceed at once with an increase in the capital to £200,000.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Alternating Electric Current Regulators of the Induction Type. M. Milch. 869. January 12th.

Portable Electric Battery Lamps. H. F. Joel. 3,185. February 9th.

Electrical Controllers. H. P. Gibbs and Sandycroft Foundry Co. 4,190. February 19th.

Electric Contacts for Operating Signal and other Apparatus on Electric Tramways or Railways. R. G. Cunliffe, J. G. Cunliffe, and E. Dewhurst. 4,230. February 21st.

Twin Electric Incandescent Lampholder. J. H. Cunningham. 4,299. February 21st.

Wireless Telegraph Receiving Stations. Marconi's Wireless Telegraph Co. and C. S. Franklin. 4,910. February 28th.

Protected or Armoured Electric Switch Fuses. H. J. Dean. 5,054. March 1st. (Cognate application, No. 13,843 of 1910.)

Regulation of the Speed of Polyphase Electric Motors. Siemens Bros. Dynamo Works. (Siemens-Schuckertwerke Ges.) 5,119. March 1st.

Electric Arc Lamps. M. J. Railing and A. E. Angold. 5,416. March 4th.

Means for Operating Electric Switches. G. Charlton. 6,704. March 17th.

Electric Coupling Device for use in Charging Accumulators. T. E. Smith. 7,593. March 29th.

Portable Apparatus for Wireless Telegraphy. Marconi's Wireless Telegraph Co., R. D. Bangay and C. E. Prince. 11,353. May 7th.

Carrying Portable Motors and Dynamos on Horseback. Marconi's Wireless Telegraph Co., R. D. Bangay and C. E. Prince. 11,360. May 7th.

Arc Lamps. A. Bisson and G. Berges. 12,119. May 17th.

Trolley Stands for Electrically Propelled Vehicles. E. L. Fixler and W. Burgess. 12,862. May 26th.

Method of Cooling the Commutator and Slip-Rings of Dynamo-Electric Machines. Brush Electrical Engineering Co. and A. W. Jones. 12,889. May 27th.

Inductive Wireless Telephone Installations. H. von Cramer. 16,419. July 9th. (Cognate applications, Nos. 18,054 and 18,333 of 1910.)

Apparatus for Reversing Internal-Combustion Engines with Electric Ignition. O. Gravdahl. 19,625. August 22nd. (September 2nd, 1909.)

Electric Switches. L. J. Sidler. 21,174. September 12th.

Telephonic Distributing Systems for Music and other Happenings. A. Nemeth. 21,700. September 19th.

Electromagnets in Telephone Call Indicators and the like. O. F. Forsberg. 22,894. September 27th. (September 29th, 1909.)

Device for Guiding Electric Cables for Internal-Combustion Engines. Firm of Robert Bosch. 24,638. October 24th. (October 12th, 1910.)

Electric Heaters. British Thomson-Houston Co., Ltd. (General Electric Co.) 26,12 . November 9th.

Electric Plug Couplings. J. Kalamba. 27,875. November 24th. (May 18th, 1910. Addition to No. 27,248 of 1910.)

The Metric System in the U.S.A.—Mr. H. W. Sullivan, who recently returned from a business tour in the United States, was charged by the Director of the Bureau of Standards with the task of obtaining publicity for the measures which have been taken by the Bureau with a view to hastening the adoption of the metric system, and we are indebted to Mr. Sullivan for the opportunity of inspecting a metric chart, pictorially exhibiting the relations between the United States and metric weights and measures in common use, which has been issued by the Department of Commerce and Labour. The design is somewhat similar to that of the familiar one issued by the Decimal Association in this country, but embodies a number of improvements upon the latter. An excellent set of Tables of Equivalents has also been shown to us. This was issued by the same office, and contains, besides a brief explanation of the metric system, detailed comparisons of the respective units, and of French, German, British and American prices, and a very complete series of tables for converting all the usual measures from one denomination to the other, the values being carried from 1 to 1,000 units in each case, and worked out in many cases to the exiguous precision of 8 or 9 significant figures. For some purposes, this degree of accuracy may be essential, but we think that so many figures are apt to alarm unnecessarily the ordinary reader, who has not been trained to appreciate the meaning of significant figures, and a set of tables giving only four significant figures would serve almost all ordinary purposes.

The metric system was legalised in the United States in 1866, and in 1893 the metric standards were adopted as the fundamental standards; the system is used in defining the U.S. coinage, and is exclusively employed in the medical work of the Navy and War Departments, as well as in the public health and marine hospital service, while in Porto Rico and the Philippine Islands its use is obligatory for all purposes. It will thus be seen that the United States Government is favourably disposed towards the system, and we may remind our readers that several of the American scientific and engineering societies, including the American Institute of Electrical Engineers, in their *Proceedings*, always give in brackets the metric equivalents of quantities expressed in English units, to familiarise their readers with the notation which they clearly recognise to be that of the system that must be adopted sooner or later—an example which we commend to British institutions. We trust that it will not be long before our own Parliament, laying aside its everlasting political squabbles, will take the matter seriously in hand and take active steps towards the establishment of the metric system and decimal coinage in this country—otherwise we shall be left the sole users of the archaic medley of units satirically known as the "English *system*."